SCIENTIFIC AMERICAN

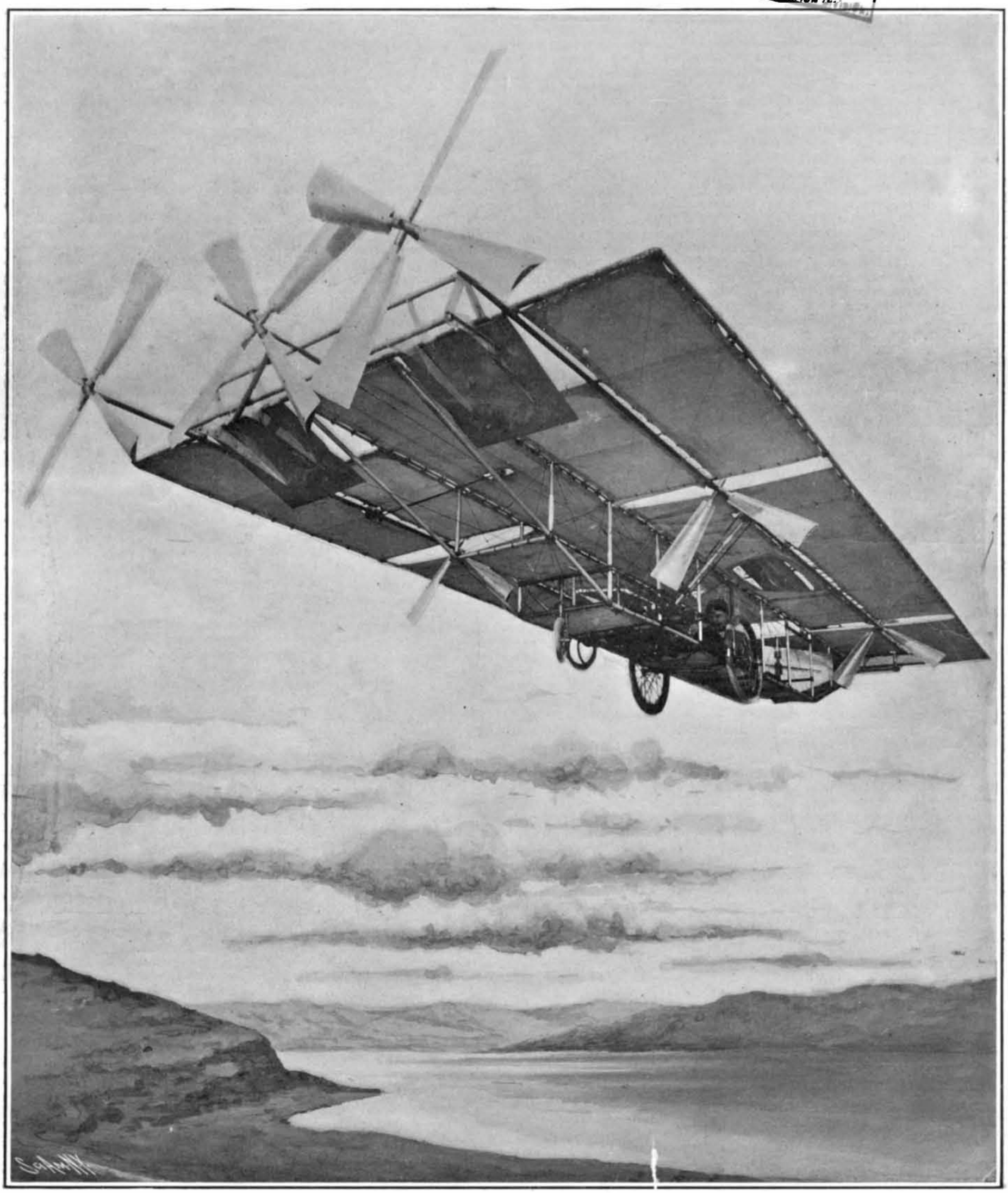
[Entered at the Post Office of New York. N. Y., as Second Class Matter. Copyright, 1905, by Munn & Co.]

Vol. XCII.—No. 25. ESTABLISHED 1845.

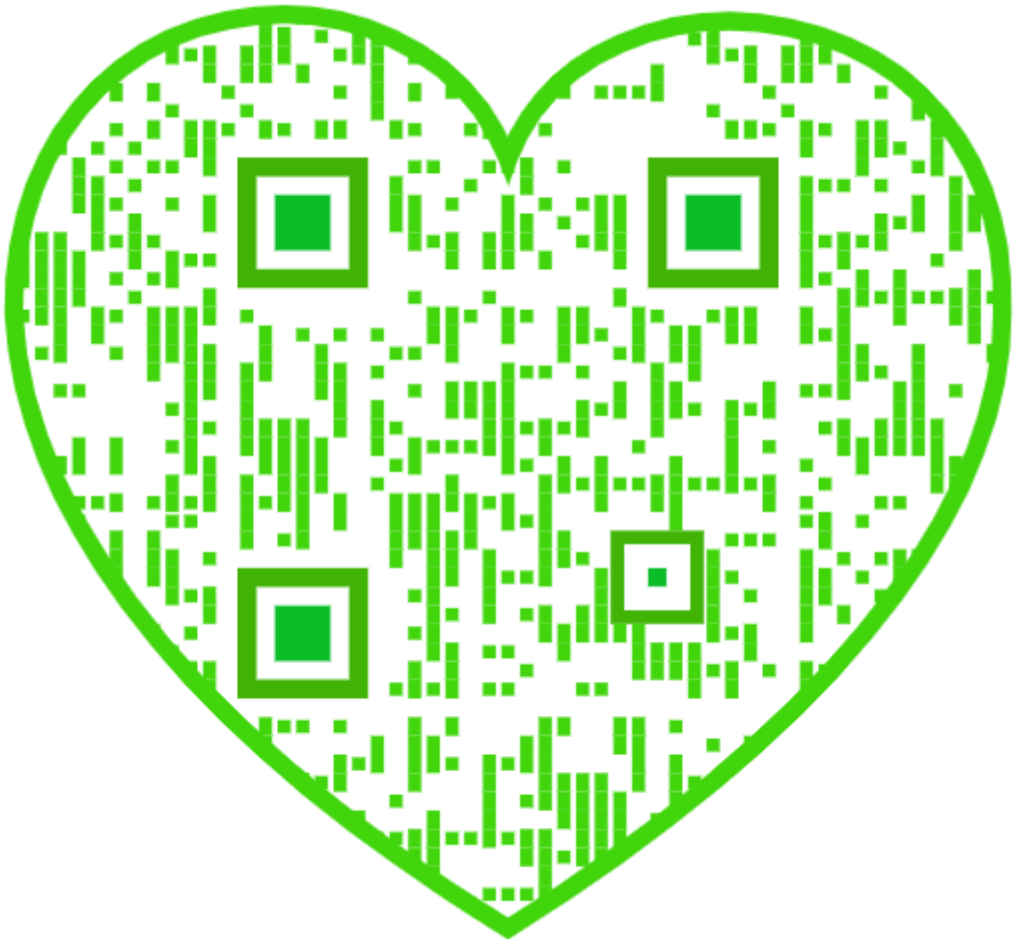
NEW YORK, JUNE 24, 1905.

10 CENTS A COPY. $3.00 A YEAR.

WAR DEPARTMENT OFFICE CHIEF OF STAFF No. JUN 23 1905 MILITARY INFORMATION



THE GILLESPIE AEROPLANE AS IT WOULD APPEAR WHEN SOARING.—[See page 501.]



SCIENTIFIC AMERICAN
ESTABLISHED 1845

MUNN & CO., - - Editors and Proprietors

Published Weekly at
No. 361 Broadway, New York

TERMS TO SUBSCRIBERS

One copy, one year for the United States, Canada, or Mexico $3.00
One copy, one year, to any foreign country, postage prepaid. £0 16s. 5d. 4.00

THE SCIENTIFIC AMERICAN PUBLICATIONS.

Scientific American (Established 1845).....$3.00 a year
Scientific American Supplement (Established 1876)..... 5.00 "
Scientific American Building Monthly (Established 1885)..... 2.50 "
Scientific American Export Edition (Established 1878).. ..... 3.00 "

The combined subscription rates and rates to foreign countries will be furnished upon application.
Remit by postal or express money order, or by bank draft or check.
MUNN & CO., 361 Broadway, New York.

NEW YORK, SATURDAY, JUNE 24, 1905.

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

INCREASING THE NEW YORK WATER SUPPLY.

If the citizens of New York understood that the margin between the city's present consumption of water and the minimum flow of the Croton River as recorded in past seasons of drought was of a negative character, the consumption exceeding the supply, they would surely be less extravagant in the use of water, and would make a decided effort to stop the serious waste which daily occurs. Meanwhile the Aqueduct commissioners, pending the construction of the great system of storage reservoirs, which has recently been the subject of favorable action by the New York State Legislature, are rushing the preliminary work for the construction of a new reservoir in the Croton watershed, which will have a capacity of ten billion gallons of water. The new structure, which is to be known as the Cross River reservoir, will impound the waters of a tributary of the Croton River, the area of whose watershed is about thirty square miles. Another dam, to be known as the Croton Falls reservoir, with a capacity of twenty billion gallons, will be located below the Cross River reservoir, and at a point below the junction of the east and west tributaries of the Croton River. These two works will add, therefore, a total of thirty billion gallons to the present total capacity of the various Croton watershed reservoirs, which in the aggregate amounts to sixty-six billion gallons. Although this represents an increase of about 45 per cent, it is a fact that with the new reservoirs completed, the total capacity of the system, in dry years such as have been known, would merely give a safe margin over the present daily consumption of 300,000,000 gallons.

Of the two new reservoirs upon which New York city will have to depend to tide it over until the great reservoirs in the upper Hudson district are completed, the Cross River reservoir is ready for bids, and the Croton Falls reservoir will be in a similar condition during the autumn. The Cross River dam, which will have an extreme height of 150 feet and a length of about 900 feet, will be constructed of cyclopean masonry with a facing of large concrete blocks, the latter having been adopted because they will represent a saving of $250,000 in money, and probably a considerable amount of time; for the securing of cut facing stone in sufficient quantities is in such work always a possible source of delay. During construction the river will be taken care of by two five-foot steel pipes, which will extend through the dam. There will be 248,000 yards of excavation to be done before the rockwork is commenced. In the dam itself there will be 132,000 cubic yards of cyclopean masonry and 6,000 cubic yards of monolithic concrete facing blocks. Some 870 acres will have to be cleared in the bed of the reservoir itself.

Since the element of greatest importance in the construction of the dam, next to its security, is the question of time, the chief engineer, Mr. J. Waldo Smith, is applying to it those methods of construction which enabled him to complete the Croton dam so rapidly. In the first place, on both the upstream and downstream sides of the dam, broad timber trestles will be constructed, to accommodate the railroad tracks that will bring the material to any part of the site. Within the structure of the dam will be built up a series of steel derricks, of the same kind as those used in completing the Croton dam, which were illustrated in the SCIENTIFIC AMERICAN of September 24, 1904. These towers will be inclosed in the masonry of the dam, as the latter is carried up. Three of these towers, 50 feet in height and 25 by 50 feet in plan, will be erected at intervals along the axis of the dam, and each will be equipped with four derricks. When the structure has been built up to a height of 50 feet, five other towers of the same dimensions in plan, and from 20 to 30 feet in height, will be erected, so as to enable the whole length of the dam to be served by the thirty-two derricks which shall be thus available. When the dam has been carried up to the top of these towers, or say to a height of 80 feet, the remaining portion will be built from wooden towers, each carrying one or two derricks, which will be built on the big trestles referred to, which will extend parallel with the face of the dam. The great success which attended this system of construction in the work of completing the Croton dam, is a guarantee that the new Cross River reservoir will be built with unusual rapidity. It is probable that the additional storage of ten billion gallons of this reservoir will be available by the autumn of 1907, and that by the summer of 1908 the Croton Falls reservoir will also be in operation. The total storage capacity of the Croton watershed will then be nearly one hundred billion gallons. Were the rainfall in the Croton watershed uniform from year to year, there would be no cause for anxiety for years to come. It is the possibility of a repetition of certain periods of light rainfall that makes the rapid execution of these two dams an imperative necessity.

THE WARSHIPS OF THE FUTURE.

As the ally of Japan, Great Britain is probably in possession of the facts as to the behavior of the ships and general war *matériel* of the Japanese navy in the present war; and hence the naval programme for the present year, as far as it has been made known by the British government, may be accepted as embodying, in the distinctly novel features of the ships to be laid down, many of the lessons that have been learned. These changes are exactly those which the SCIENTIFIC AMERICAN has predicted would be brought about as the result of the war, namely, a great increase in gun power, and a corresponding increase in speed. Dealing first with the battleship (the foundation upon which a navy is built up, and around which its various elements are gathered) we note that the British Admiralty are to lay down a vessel which, if it proves to be satisfactory, will become the standard type of battleship for probably a decade to come. In the first place, the speed is to be that which only a few years ago was the standard speed for armored cruisers, namely, 21 knots an hour. This would be a remarkable battleship speed, even if sacrifices were made in the armor protection and the batteries; but as a matter of fact, in spite of the high speed adopted, the ship will be considerably larger and more powerfully armed than any battleship built or building to-day, exceeding even the "Lord Nelson" type of last year, which on a displacement of 16,500 tons is to carry four 12-inch and ten 9.2-inch guns.

The new ship will mount a battery of ten 12-inch guns, each of which will have a muzzle energy of about 50,000 foot-tons. All of these guns will be carried in turrets upon the main deck. There will be no intermediate battery; but for defense against torpedo-boat attack, the new ship will be fairly alive with high-velocity 3-inch guns, of which she will probably carry not less than two or three dozen. Steam will be supplied entirely by water-tube boilers, and she will be driven by Parsons steam turbines of 23,000 horse-power. The embodiment of such speed and gun power necessarily implies a great increase in the displacement, which in the new-type ship will be not less than 18,000 tons. The great powers of attack of this vessel can be best understood by a comparison with the two next most powerful battleships in the world, the British "Lord Nelson" and our own "Connecticut"; for while the total energy of a single broadside from the "Connecticut" is 297,000 foot-tons, and that of the "Lord Nelson" 312,000 foot-tons, the seven 12-inch guns of the new battleship which can be brought to bear on either broadside will have total muzzle energy of about 350,000 foot-tons. This is the energy at the muzzle; but since the big gun holds its energy longer than the smaller gun, it follows that at the long battle ranges at which the engagements of the present war have been fought, say three to six miles, a broadside from the new type of battleship, if every shot got home on the enemy, would have about 70 per cent more striking energy than the broadside of the "Connecticut," and about 30 per cent more than that of the "Lord Nelson." Furthermore, because of her excess of speed of about three knots an hour, she would have the "weather gage," and could choose the distance and the position that would be most favorable to herself.

A similar increase in speed and power is to be made in the new design of British armored cruisers, of which four are to be built. With their turbine engines, they are expected to realize a speed of 25 knots an hour. As in the battleships, the 6-inch gun will disappear, and with it the port or casemate method of mounting the gun; and a powerful armament of ten or twelve 9.2-inch guns will be carried on the main deck, all of them within turrets. Like the battleship, these vessels will have the weather gage of any armored cruisers afloat on the high seas; moreover, as the 9.2-inch gun is to be 50 calibers in length, its high velocity and great carrying power will render these armored cruisers a match for many of the smaller and older battleships, that are armed with short-caliber 12-inch guns. One of these 25-knot cruisers could, for instance, circle around the battleship "Iowa," at a range at which the chances of scoring a hit with the low-velocity 12-inch guns on that ship would be rather remote, and because of the flat trajectory of her own 50-caliber 9.2-inch guns, she would be capable, did she carry first-class gunners, of placing her shots with telling effect. Just here, as showing the rapid strides made by modern gunnery, we may mention that the 9.2-inch 50-caliber gun of this cruiser has about the same muzzle energy as the 35-caliber 12-inch gun of the "Iowa," and of course a much flatter trajectory. These four armored cruisers will constitute a squadron, whose 25-knot speed will enable them to refuse battle to the modern battleships; close with any battleships armed with 30 or 35-caliber pieces, and, by virtue of their long-range guns, have the battleships at a great disadvantage.

In the new British destroyers, an even greater relative increase in speed is proposed. Two classes are to be built, one for work off the coasts, and the other for duties on the high seas. As in the case of the battleship, a type vessel, to be followed by others if it proves satisfactory, will be built, and the estimated speed, with turbine engines, is 36 knots an hour. This speed is to be no mere racecourse achievement, run over a measured mile under favorable conditions; for the 36 knots an hour trial speed must be maintained over a distance of nearly 300 knots, or for a period of eight hours' continuous steaming. Five destroyers will also be built which must maintain a speed of 33 knots an hour for a period of eight hours. The coast destroyers, of which a dozen are to be constructed, are to have a speed of 26 knots an hour.

It is significant that in this programme there is no mention made of the building of cruisers of the unprotected class, and herein the SCIENTIFIC AMERICAN finds a further verification of its stated belief that the torpedo-boat destroyer will grow in size, until it has rendered the unprotected cruiser or scout a superfluous type. The new 33-knot ships will probably be of not less than 1,000 tons displacement, and will combine in themselves the qualities both of the scout and the destroyer.

EYE-STRAIN AND HOW IT CAN BE RELIEVED.

In a recent number of the Journal of the American Medical Association, Dr. Lewis S. Dixon, of Boston, makes some interesting observations in regard to the above-named topic. He calls attention to the fact that the eye has always been studied simply as a part of the body, under physiology, and contends that it needed to be studied as an optical instrument, under optics, a branch of science in which our knowledge is mathematically accurate. The usual explanation that eyes are naturally weak and may be rested by an avoidance of work is declared to be erroneous, and the conviction is expressed that no organ of the body should fail to perform its own particular function or show difficulty in its performance unless something is out of order. The proper thing to do, according to Dr. Dixon, is not to give up its use, but to find the trouble, to correct it if possible, and to restore the organ to usefulness.

The writer informs us that the eye varies as much as everything else in the human body. "Each person," he states, "is born with his own pair of eyes; sometimes they are correct, oftener not so. Often they are not alike and cannot work together properly." Vision is corrected by the ciliary muscles, which are made to work; but when they are overtaxed, they are liable to exhaustion and this, in turn, gives rise to serious consequences. It is found to be an actual fact that eye-strain is often the principal factor producing nervous debility, hysteria, melancholia, vertigo, nausea, insomnia, nervous dyspepsia, palpitation of the heart, general nervousness, irritability, faintness, weariness, headaches, constipation, and dozens of other annoying conditions.

Eye-strain, the author maintains, is a permanent waste of nervous energy in correcting the slight congenital and permanent errors in the shape of the eyes. This waste is not felt by a strong, healthy system, but is ready to become a decided tax whenever the system gets below par, and its effects are intensified immensely by continued close work.

When once the muscles have been taxed to the point of exhaustion, and nervous reflexes or disturbances set up elsewhere, then any effort to force the eyes to continue their work may cause actual physical damage requiring a long time to repair. It is like the breakdown that comes from overwork in any other way—repair is slow and sometimes never perfect.

Now that the cause of eye-strain is known, we have the choice of two methods of relief—we may remove the conditions that make it a burden, or we may correct, but not remove, the cause.

Theoretically, the doctor insists, glasses should be worn constantly since the errors are fixed, but if the eyes can once learn how to rest, they are usually able to bear their overwork a fair share of the time without bad results; but they must have rest, and at frequent intervals.

The dislike to wearing glasses is so great and universal, the reason for wearing them so little understood, and the temptation to the oculist to avoid forcing such an unpleasant remedy on his patients is so strong, that they have been worn generally for close

work only, or for temporary relief, and as little as possible. But if glasses are needed at all they are really more beneficial when worn for resting or distant vision than for close work; but that is exactly opposite, the author tells us, to what people wish to do or find agreeable. Too many people decide to follow their own inclination, but are sure to find later that the cost of so doing is much greater than they had expected.

Glasses do not do a bit of the work the eyes ought to do; they simply correct imperfections. In conclusion Dr. Dixon states that, contrary to the general idea, sharp, clear sight, so highly prized and the boast of many, is not the proof or the test of a good eye; for many who have the keenest vision cannot use their eyes much or with any comfort. Easy vision, he maintains, vision that can be used and enjoyed freely, without thought or fatigue, is the proper test of a good eye.

ELECTRIC WAVES AND LIQUIDS.

An Italian scientist, Prof. V. Buscemi, has recently made a series of observations in order to determine the transparency of liquids for electric waves. For such experiments it is necessary to have a very sensitive apparatus for detecting the waves and making the comparative measurements. The author used an apparatus which is based, like Prof. Fleming's, upon the magnetization of iron by the action of the electric waves, but here he uses a galvanometer instead of a telephone. To produce the waves he places the oscillator in an iron case provided with a copper cover. In order to have a complete metallic continuity of the case, the border of the cover has a flange form and dips into a circular groove containing mercury. In one of the sides of the case is a two-inch opening, over which he can dispose a glass tank some 0.25 inch thick. The latter is fixed to the case by a lead cement which is found to be entirely opaque to the electric waves. In this way none of the waves can leave the case without passing through the liquid contained in the tank. By this arrangement Prof. Buscemi found that among the liquids which absorbed the electric waves, the acids occupy the first place, as their absorbing power is greatest. Distilled water is much less transparent than air, and the latter is less so than vaseline oil. A solution of salt (one per cent) is opaque when in a thin layer, also sea water which contains some three per cent of salt. Ether, benzine, and petroleum are more transparent than distilled water, but less so than air.

RECLAMATION WORK IN SOUTHERN CALIFORNIA.

BY C. J. BLANCHARD.

The American Riviera, that beautiful valley in southwestern California in which nestles the delightful city of Los Angeles, is confronted with a perplexing problem. It is a question of water supply to meet the increasing needs of a community growing with remarkable rapidity.

The cultural development and rapid increase of population in the valleys are limited by the available water supply. As far back as a quarter of a century this supply was fully appropriated, and underground sources began to be drawn upon. To-day these wonderful reservoirs, hidden deep in the earth, which the optimistic westerners had come to regard as inexhaustible, are showing signs of giving out. Within ten years the artesian areas in which flowing water is or has been found have shrunk from 375 to 250 square miles, a loss of 33 per cent. The conditions naturally occasion grave concern, for it is recognized that upon the regulation of the acreage which safely may be supplied with underground waters for irrigation, depends in a large measure the future greatness of these coastal valleys.

Several years ago the United States Geological Survey began a systematic study of the peculiar conditions in this district, and very interesting and important data have been collected concerning the geologic and hydrographic features. The people of southern California are squarely facing these problems, and a determined effort on their part is being made to bring into this section new and distant water supplies, not only to provide for present conditions, but to meet fully the needs of the future. Distant watersheds are being examined, and plans for lifting streams from their present beds and carrying them over and through mountain areas, at a cost of millions of dollars, are being discussed in a manner thoroughly characteristic of this progressive people.

Historically, southern California offers one of the most interesting chapters on irrigation to be found anywhere in the arid West. It was during the period when our nation was yet in embryo, before Boston's tea party and the Declaration of Independence had startled the great monarchies of the Old World, that the mission fathers in this far-off valley on the Pacific slope began to teach the Indians the gentle art of husbandry. Coincident with the establishment of the Church, the cultivation of the soil by irrigation was undertaken. With the aid of the Indian converts stone dams were thrown across some of the streams, lines of canals were constructed covering wide areas, and even pipe lines made of burnt tile and mortar were utilized to make tillable the stubborn glebe.

When the American pioneer came to California, attracted by the discovery of gold, he quickly noted the abundant crops of the missions which followed irrigation, and it was not long before many of the abandoned mining ditches were utilized for agriculture.

Early in the sixties of the last century there began an era of substantial development, with works of more permanent and enduring character. By 1880 so precious was the water found to be, and so abundant the rewards following its application to the soil, that practically the entire flow of the streams was diverted and utilized. Stimulated by the very high values of the California citrus lands and the small acreage under irrigation compared with the irrigable area, a thorough investigation was begun of all the possibilities for water development.

The physiographic features of the valley are varied and interesting. The San Gabriel and San Bernardino mountains, which constitute the northern and eastern boundaries of the valley, intercept the moisture-laden clouds from the Pacific. The precipitation on their western slopes forms the perennial streams, the diversion of which has made possible the high state of cultivation that has given some of the orchard lands values of from $500 to $2,000 per acre. Owing to the steep slopes of the mountains, and to the fact that the greater part of the annual rainfall occurs during winter storms of short duration, there has always been a heavy loss of water through floods. The narrow river canyons offer slight opportunity for storage, and but few projects of this kind actually have been constructed.

These valleys and plains are not normal, but are made up of a series of deep filled troughs separated by ridges, which rise higher and higher toward the interior. These troughs and their separating ridges have been formed by geologic processes. The rivers, having existed before the geologic period which created the troughs and ridges, have maintained their way across them from the higher mountains to the sea, cutting their channels through series of ridges and filling the intervening basins with sands, gravels, and clays. As the streams emerge from the mountain canyons their velocity is lessened, and the heavier bowlders, gathered by erosion, are first deposited. The deposit becomes finer and finer as the streams proceed, until the tiny particles which sift downward form a sheet of impervious clay. These clay caps slope with the streams, and the water percolating through the gravels of the basins accumulates behind them, gathering pressure from the ever-increasing weight of waters, and producing artesian wells wherever the clay covering is pierced. When the underflow encounters the ridge at the outlet of an upper valley, the water is forced to the surface, and flows on to the next basin where, unless diverted, it sinks into another gravel-filled basin. These basins are not only storage reservoirs, but act as effective regulators of the hide-and-seek rivers, protecting them from evaporation and contamination, and producing a remarkable uniformity of flow at the canyon.

The history of irrigation in this valley is one of steady growth and development. Southern California now leads the United States in the diversity of methods of application, in scientific and detailed distribution, and in the expensive character and boldness of design of its irrigation works. All the irrigation conduits are either cement-lined canals or pipes. The irrigation systems in this part of the State are known all over the world. Surface water, drainage water, seepage water, water from artesian wells, from tunnels penetrating the mountains, and waters impounded in reservoirs are alike utilized.

This intensive development was partly the result of a series of dry years which began about a decade ago. The preceding ten years were years of unusual rainfall, and the acreage brought under cultivation was in excess of that which could be supplied by surface streams when the dry period came on. California's most important and valuable crops are perennial plants, citrus and deciduous fruits, and walnuts, and the failure of the water supply for a single season means an enormous loss to the irrigator. The successful installation of the Gage canal system, which was completed in 1886 to cover 7,500 acres of citrus lands, and which furnished a splendid example of the feasibility of utilizing the underground waters, gave an impetus to the development of this source which has been continued until now there are nearly 3,000 wells and about 1,600 pumping plants in operation, representing a capital of approximately $3,500,000, and having a combined continuous flow of from 400 to 500 second-feet. There are few important irrigation systems whose supply has not been augmented during the past ten years by artesian or pumped waters, to make up the deficiency in stream flow.

While the underground reservoirs, which have proven of incalculable value to the irrigators of southern California, are of such enormous extent that they more than compensate for the lack of storage facilities, the fact can no longer be overlooked that the drain put upon them in the past few years has resulted in a notable decline in the water levels. A system of observations upon the fluctuations of ground-water levels is in progress under the direction of the United States Geological Survey, but it will be of increasing value if continued for a period of years. One notable fact has been discovered. The water level has been steadily declining, even in years of normal rainfall, so that the reclamation of virgin lands through the indiscriminate increase in the number of wells is a menace to the present irrigation systems. A series of years of increased rainfall may possibly restore the volume of ground water, but it is an unsafe assumption to make in the absence of scientific records showing this to be a fact.

ENGINEERING NOTES.

Like so many other details not only in marine engineering but in other lines of work, features which are introduced in a practical way in recent times are found to have a comparatively ancient origin. This is true of the water tube boiler, which in its recent use dates from about 1880. The excavations at Pompeii have shown small boilers almost identical in construction with some of the best of our water tube boilers, although they were doubtless only used for a circulation of hot water.

During the official trials of the new turbine steamer "Onward" for the Dover-Calais channel service of the South-Eastern Railroad, a record for this class of vessel was established. The "Onward," which was built by the Messrs. Denny Bros., of Dumbarton, is practically a sister ship to the "Queen," which has been plying upon this route for many months past with complete success. A large number of improvements, however, have been embodied both in speed and comfort. In the mile run on the Firth of Clyde, a mean speed of 22.54 knots was attained. Another noteworthy feature of the trials was the remarkable speed of fifteen and a half knots which was attained with turbines reversed. The "Onward" will be able to cover the distance between Dover and Calais in 45 minutes, which is an acceleration of ten minutes upon the scheduled time of the sister ship "Queen."

Municipalities have a right to insist upon the abatement of black smoke by all users of steam boilers, without regard to the purposes for which the steam is used or the means to be adopted for abatement. This, because smoke is a public nuisance and because it can be abated without hardship to the owner of the plant. Nevertheless, when the evil is present and has been present for a period of years, it is not good policy to be too radical in the enforcement of the statutes. The law should be definite and stringent and the penalties adequate, but they should be enforced with discretion by officials who have some technical and practical knowledge of smoke abatement. It is absurd to talk of putting this matter into the hands of the police or of the health officer. The official having charge of this work should be a trained engineer, if possible a technically educated man, and he should be entirely above graft in any of its disguises.

German papers state that acetylene gas, generated from calcium carbide by the simple addition of water, has not met expectations, which, however, were very great. On account of the ease with which a gas for lighting purposes could be obtained, it was believed that it would be used very extensively, but the boom in the acetylene industry did not last long. New uses for the gas have been looked for for some time. The latest invention is its use as an explosive. By means of an air mixture, explosive force is obtained which can compete with that of powder and dynamite. The explosion takes place in an air chamber and is caused by an electric spark. For this purpose carbide of calcium is reduced to small particles and put into a cartridge, consisting of a tin box. In this the carbide lies at the bottom and above it is a partition filled with water. Above this is a vacant space with the electric percussion device. On the side of the cartridge is an iron pin by means of which the partition between the carbide and the water can be perforated. After the drill hole has been completed the cartridge is placed into it and the hole is closed with a wooden stopper. Then the protruding iron pin is dealt a blow, by which the partition is perforated and the water is caused to come in contact with the carbide, whereby acetylene gas is generated. This mixes with the air of the drill hole. After five minutes the gas is ignited by an electric spark. By this method of blasting the rock is said to be not thrown out but rent with innumerable cracks, so that it can be easily removed afterward. About 1.7 ounces of carbide, which produce about 16 quarts of acetylene gas, is used for each cartridge.—Mines and Minerals.

At the commencement exercises of the Western University of Pennsylvania, the honorary degree of Doctor of Science was conferred upon Dr. Marcus Benjamin, of the United States National Museum, whose name will doubtless be familiar to the readers of the SCIENTIFIC AMERICAN as that of a frequent and valued contributor.

THE DEVELOPMENT OF A MOLLUSK.

Scattered all along the Atlantic coast, from Labrador to Florida, is a genus of mollusk known to zoology as *Crepidula* which, despite its abundance, has been so little studied that only comparatively recently has anything definite about its embryology been known. To Prof. E. G. Conklin, of the University of Pennsylvania, we owe the first account of the life history of crepidula. With the results of Prof. Conklin's inquiry before him, Dr. Dahlgren, head of the department of preparation of the American Museum of Natural History, has directed the making of a series of models to illustrate the life history of crepidula, of which models the accompanying illustrations are photographs. The models excellently show those series of active changes which take place in the nuclei of a living cell in the process of division, changes which are designated by the general name karyokinesis. Furthermore they show that many of the organs of the fully-formed animal may be traced back to certain individual cells in the early division stages of the egg. Each of these first-formed cells has its own peculiar shape, size and position, and it invariably gives rise to a particular organ, or part, of the developed animal.

In Fig. 1 we see the undeveloped egg of the crepidula. The two dark spots represent the male and female, or sperm and egg, nuclei which do not fuse before the appearance of what is known as the division spindle. The dark zone represents the animal pole of the egg, or the protoplasmic portion; the lower or more lightly tinted part is the yolk, constituting the vegetal pole of the egg. Two polar bodies are invariably thrown off during the maturation of the egg, which precedes its union with the spermatozoon. Every nucleus contains a substance known as chromatin, which, in the process of division, forms various colored figures, such as disks and threads.

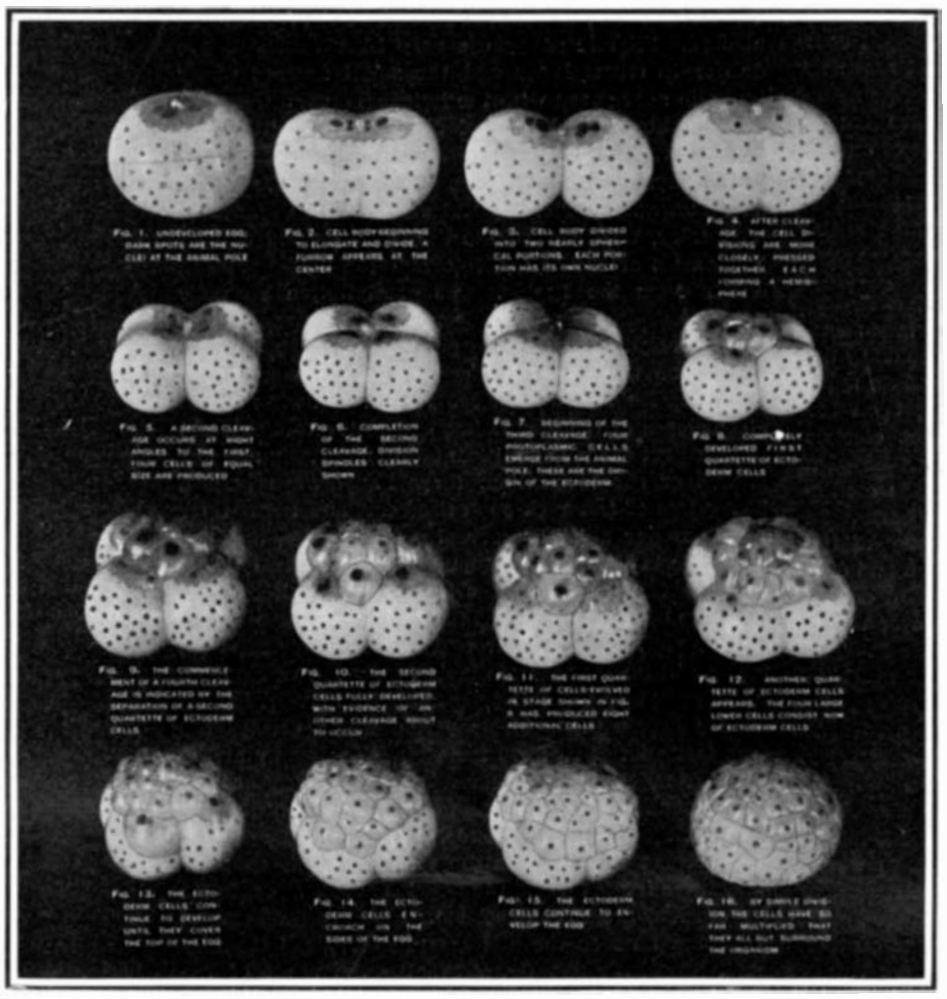
After the chromatin has been distributed equally to the two poles of the division spindle the cell body begins to divide, as shown in Fig. 2. The egg elongates and the entire cell is constricted about the central axis. The cell body then divides into two equal portions, which are at first nearly spherical and touch each other only at a comparatively small surface, as shown in Fig. 3. Each of the halves thus formed has its own nucleus, the two nuclei shown in Fig. 1 having each given up half of its material to form one of the new nuclei. Later the two cells are more closely pressed together and the surface of contact becomes larger, so that each cell forms a hemisphere (Fig. 4). One of these cells forms the anterior half of the future animal, the other the posterior half.

The peculiar karyokinetic markings, shown in Fig. 4 by the four black spots at the upper pole of the egg, indicate that when the cell has reached this stage, another cleavage is about to occur in a plane at right angles to the first. Two fairly independent furrows are produced, appearing near the animal pole and running around until they reach the vegetal pole, forming four blastomeres of approximately equal size. The same elongation of the two cells which characterized the beginning of the process of cleavage, as illustrated in Fig. 2, again takes place. Each nucleus during division breaks into what are known as division spindles, the production of which also marked the first cleavage (Fig. 2). In Fig. 6, the second cleavage is shown complete. This second cleavage lies in the median plane of the future animal and divides its body into right and left portions.

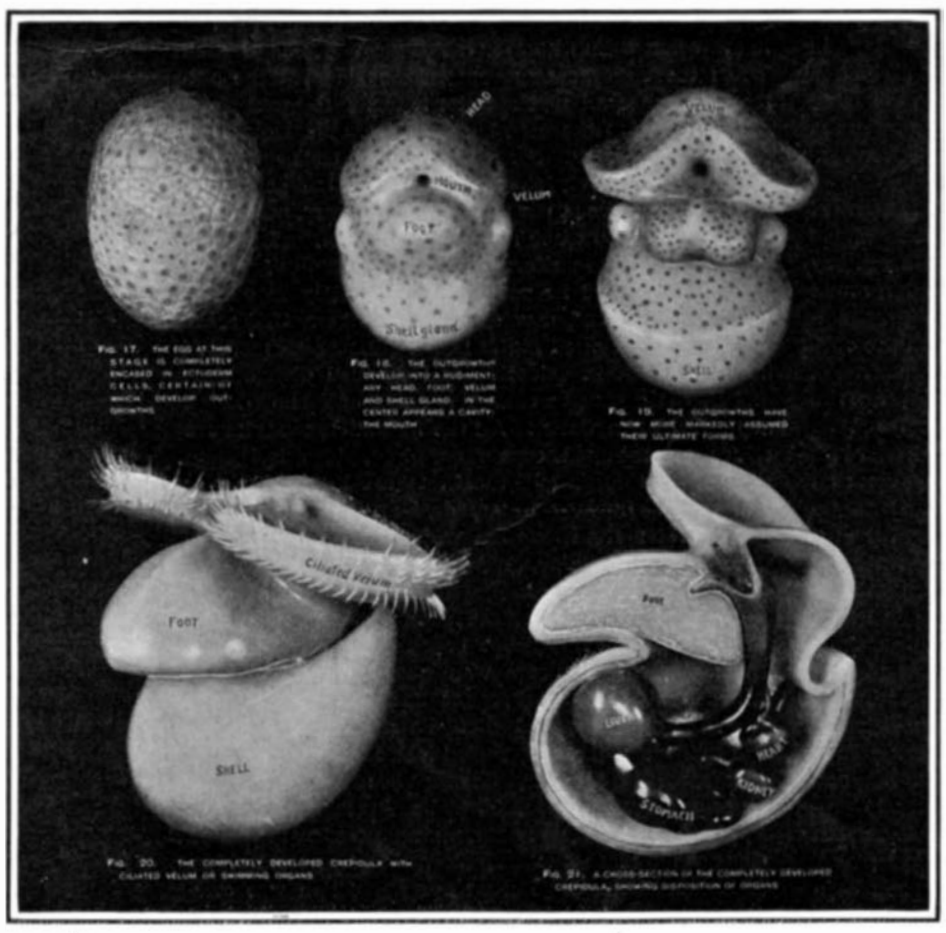
Up to this time, cleavage has been equal. There have been two cleavage planes at right angles to each other; but now another phenomenon takes place. The next cleavage gives rise to four small protoplasmic cells at the animal pole of the egg. These are the first beginnings of the ectoderm, which is subsequently to envelope the whole egg and become the integument of the animal's body (Fig. 9). The head and brain of the future animal come from these four small cells.

In Fig. 9, the beginning of the fourth cleavage is indicated by the separation from the larger cells of another quartette of small ectoderm cells. These develop until they assume the size and shape shown in Fig. 10. As the animal continues to grow by this process of division, the first quartette which was formed in the stage shown in Fig. 8 has been split up into eight cells, so that we now have twelve ectoderm cells in all (Fig. 11). The karyokinetic figures in the larger cells indicate that the separation of a third quartette of ectoderm cells is about to take place. The second and third quartettes give rise to all the ectoderm of the future animal except that over the head. A large cell is now formed at the posterior pole of the egg (Fig. 13) which contains all the substance of the middle layer or mesoderm of the future animal. The four lower large cells, which now, after separation from those of the ectoderm and mesoderm, consist entirely of entoderm cells, are destined to form the internal lining of the future mollusk's digestive organs. Tracing the process of evolution still further we find that in Figs. 13 and 14 the ectoderm cells have increased by simple division until they cover the top of the entire egg. Finally, in the stage represented in Fig. 16, these cells are shown all but surrounding the embryo. Soon they completely surround it, leaving only a very small opening—the mouth (Fig. 17). The embryo now assumes a more decidedly ovoid shape. Certain lines of cells shown in Fig. 17 develop into outgrowths or projections, constituting the more striking features of Fig. 18. These outgrowths are the head at the top and the velum which lies below it; the foot in the center, with the mouth a mere cavity above it; and at the bottom a gland which secretes the shell. In Fig. 19, we find these outgrowths have more pronouncedly developed into the forms they will ultimately assume. The velum assumes almost a mushroom-like appearance. Finally we have the fully developed larva or veliger, shown in Fig. 20. Here we see the velum with its several rows of cilia, which are nothing but swimming organs highly essential to a sessile mollusk, because the animal is dependent upon them for the distribution of the species. In Fig. 21, we have a median section of the completely developed mollusk, each of the parts being properly labeled.

The terms velum and veliger require some explanation. The velum, as its name indicates, is a veil or sail which is a highly characteristic ciliated formation of the molluscan embryo serving as an organ of locomotion in that stage when the embryo is called a veliger. It is usually soon lost, but in some cases it is retained permanently in a modified form.



The First Stages of a Mollusk's Growth.



The Last Stages of a Mollusk's Growth.

THE DEVELOPMENT OF A MOLLUSK.

New Fire-Damp or Gas Indicator.

A new automatic apparatus for indicating the presence of illuminating gas or fire-damp in the atmosphere has been brought out by Messrs. Hauger and Pescheux, of Paris. The apparatus is composed of a very sensitive balance which carries at one end of the beam a tight recipient containing ordinary air, while it is balanced at the other end by a plate having the same surface. Thus the apparatus is at rest when the surrounding air is in the normal condition for respiration. Should the composition of the air change, its density is modified according to the amount of gas which is mixed with it. In this case as the air which the vessel contains is invariable, seeing that the vessel is tight, the balance is destroyed. If the foreign elements are lighter than the air, the vessel goes down, and the reverse is the case where the mixture becomes denser than the air. The balance is arranged so as to plunge a needle into a mercury cup and close an electric circuit. Thus a bell can be rung or other apparatus worked even at a distance, and this can be of great utility for mines. In the case of private apartments the current can be made to operate an automatic device for opening a window, ringing an alarm bell at the same time. As the needle is regulated at will, we can make the apparatus work for any desired degree of the gaseous mixture. In order to neutralize the atmospheric influences of temperature and pressure, the inventors use two compensating devices which are mounted upon the scale beam. One of these is used to correct the pressure variations and consists of an aneroid chamber which acts on a multiplying lever so as to displace a rider along the scale beam, thus keeping the balance constant under varying air pressures. Heat influences are compensated by a composite metal spiral which acts upon a lever and shifts a rider upon the beam in the same way. When once it is accurately calibrated, the instrument is invariable at different temperatures and pressures.

The power generated in a modern steamship in a single voyage across the Atlantic is enough to raise from the Nile and set in place every stone of one of the great pyramids.

THE GILLESPIE AEROPLANE.

BY CHARLES B. HAYWARD.

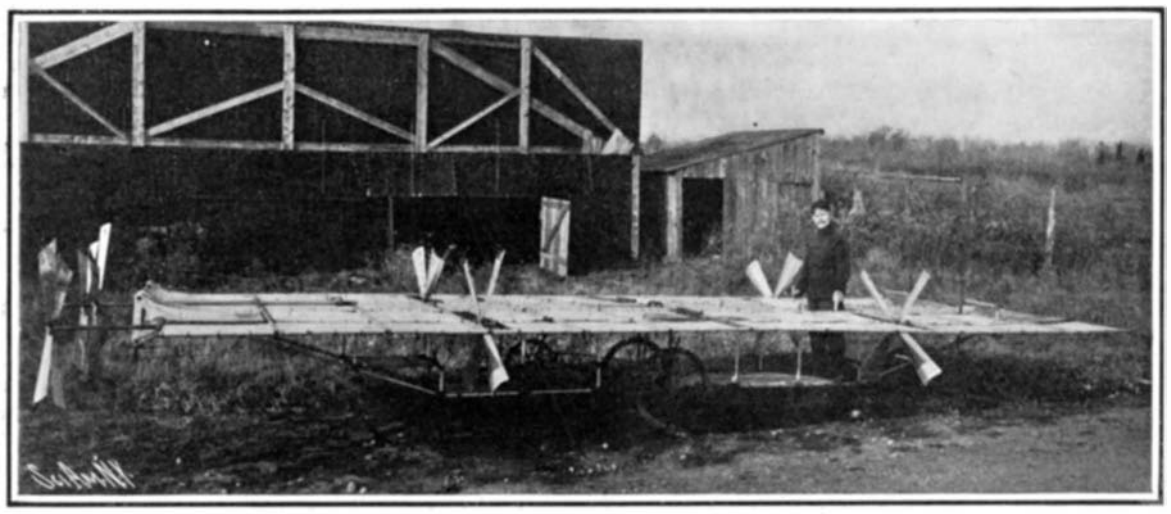
Aeronauts may well be divided into two general classes, although there are many subdivisions of each which might be deemed to be of sufficient importance to be classified individually. Of the two sharply divergent schools under which all others may be brought for the sake of convenience, the first may well be said to consist of those followers of Montgolfier who still pin their faith to the balloon, but in the present state of the art have made dirigibility their aim. The other general class comprises that army of investigators who have discarded the lifting power of gas and depend solely upon plane surfaces and mechanical propulsion for this. There are so many subdivisions of this last class that it would be hopeless to attempt to enumerate them, but probably they can all be brought under two heads—the followers of the fixed aeroplane idea moved by propellers or something similar, and those in which the movement of the planes themselves is relied upon to produce this, as do the wings of the bird in nature. Experiments in both fields date back for more than half a century, and it is not at all unlikely that attempts have preceded this by many years, but have gone unrecorded. How to impart sufficient speed to the apparatus to overcome the wind pressure is the problem presented in both instances, and its solution is in either case attended with difficulties that appear well-nigh insurmountable.

The lifting power of hydrogen is so small compared with its volume that in order to provide sufficient latitude to cover the weight of motive power, crew and accessories, the size of the envelope must be increased until the area it presents makes the factor of wind pressure absolutely prohibitive. In order to combat the latter at all a horse-power entirely out of proportion with the weight of its generator is imperative and the available capacity of the latter is restricted within closely defined limits by the small surplus to be devoted to this purpose after the lifting power of the balloon itself and the crew has been deducted, and this in turn determines the possible speed. That this is closely restricted is evident, for the resistance grows as the square, and the horse-power required as the cube, of the speed.

The principle of the dirigible balloon has been pretty well evolved, but the maximum attained with this type has been a speed of 18 miles an hour—Count Zeppelin's balloon—and a distance of five or six miles. On the other hand, a balloon has made a sustained flight of twelve hundred miles, with the wind. Thus the only practical advance over first principles has been found in the dirigible balloon, but while the latter has the advantage of providing independent flotation its many disadvantages are apparent, and at best, though it may serve useful ends in war or exploration, it is a costly toy with which few but governments can afford to experiment.

There is an element that must perforce be lacking in every attempt of man to imitate the flight of the bird and that is the spark of life—the nerve center that man has never succeeded in endowing any of his creations with. Many of the attempts to reproduce the bird's flight have been crude and fanciful, although they are of some value to science. On the whole there is no difficulty in merely simulating the movement of a bird's wings nor in reproducing the surfaces its wings present to the air.

When man steps on the "yellow peril" in the shape of a banana skin and is threatened with a sudden loss of his center of gravity, a subconscious effort flashed from his nerve center pulls him up, and in the majority of instances saves his loss of dignity if nothing more. It is the same with the bird; violent gusts of wind from every direction strike it on all sides in its flight, but this same subconsciousness with which all beings of a sufficiently high order are endowed suffices to save it from being capsized in the air or blown against obstructions in its path. Whatever it may be termed, intuition, instinct, or an unknown quantity, it is this unconscious effort made in far less time than it would be possible to accomplish any voluntary movement that preserves the center of gravity.



The Aeroplane Ready to Start.

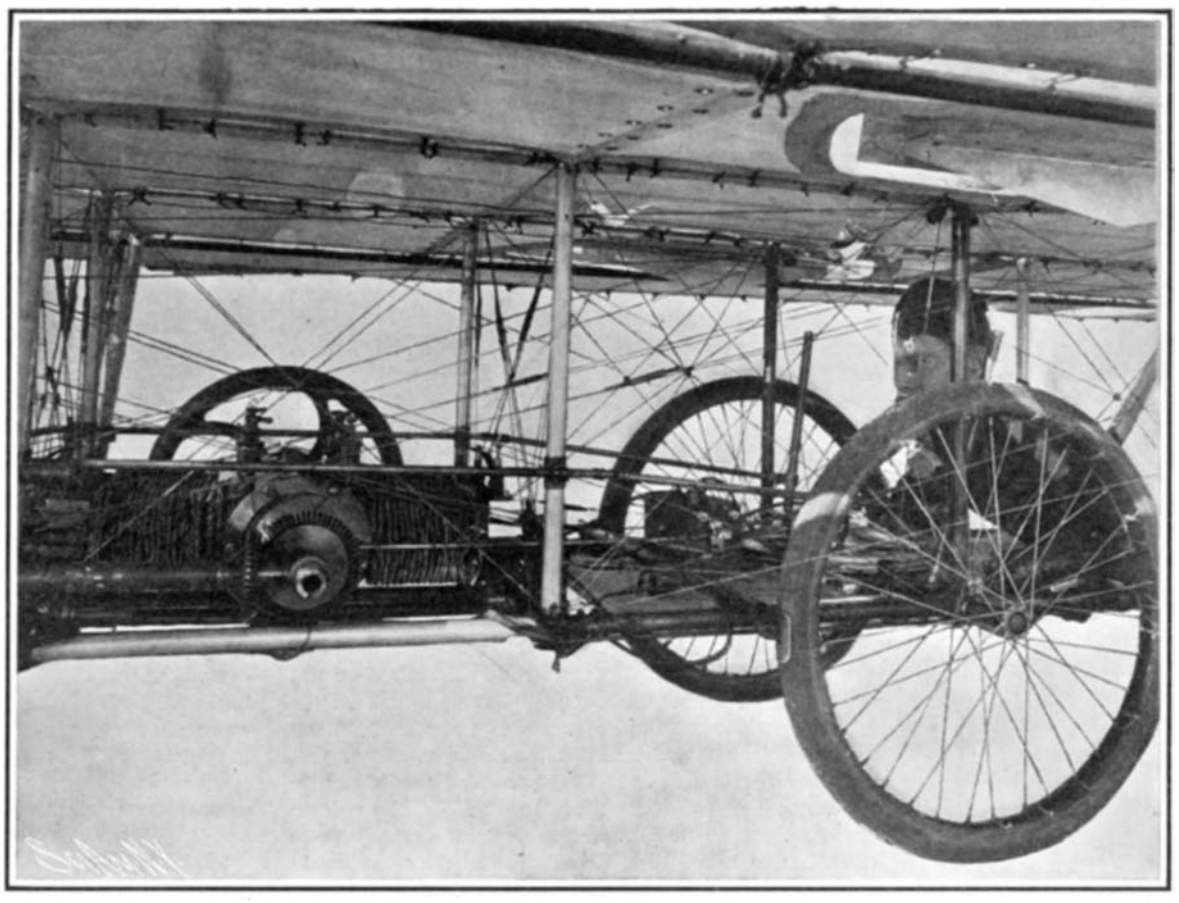
If illustration were needed that this is the *sine qua non* without which the true flying machine is a practical impossibility, it is only necessary to revert to the many fatalities that have ended man's attempts to fly in various instances. Every aeronaut who has reached the stage of making practical experiments in aviation has had to recognize that provision for shifting the angle of incidence and for preserving the equilibrium is a matter of paramount importance—indeed, a condition precedent to any extended flight.

"Upset in the air" tersely explains the deaths of Lilienthal and Pilcher, who demonstrated a great deal in their numerous gliding experiments, but nothing so conclusively as the fact that until there can be some means of automatically preserving the equilibrium—some nerve connection from the wings of the aeroplane to the nerve center exemplified by its operator—no amount of skill or dexterity on the part of the latter can suffice to save him in the end. Even the birds are at times suddenly "up-ended" in battling against the gale, and their recovery is due solely to this force of unconscious cerebration that does the right thing at the right moment without conscious effort. But should the bird actually meet with disaster in the shape of capsizing, the chances of recovery before striking the ground are so great that the latter seldom if ever occurs. In the case of the aeronaut recovery is out of the question.

Probably the chief reason why more has not been accomplished with the aeroplane lies in the fact that such meager opportunities to study it in action have been presented. "Defective equilibrium" epitomizes the failure of practically every attempt at flight with a true flying machine since experiments have been made along this line. Shifting the weight of the operator to vary the angle of incidence and numerous devices to shift the planes, the addition of side planes, tails and similar devices to accomplish the same object—all theoretically correct—have been found to fail when put to the test. It is the claim of G. Curtis Gillespie, of New York, who has made a close study of the subject along this particular line for a number of years, that in his flying machine principles are embodied that permit of the operator's becoming imbued with a sensitiveness to the movements of the aeroplane when in flight that, with a little experience, the closest approach ever made to this same subconsciousness of the bird will be attainable.

The effective area of the Gillespie aeroplane is approximately 240 square feet, and the designer, while being perfectly familiar with the great advantages of the curved plane, is confident that with the great amount of power developed by the seven aluminium propellers, each of which is slightly over three feet in diameter, the form of plane used in this machine is not only very much more difficult to "up-end" when in flight, but is likewise not so easily capsized laterally, this being a fatal defect in many of the extremely light machines with curved planes. This small plane is moreover more easily handled than an extremely wide convex plane or several of them, as usually adopted.

The dimensions of the machine are 24 feet over all with a beam of 10 feet, the plane being of light duck, its surface being cut into at each end to provide for aluminium movable planes in order to vary the angle of incidence. In order to do this, they are connected by light wire cables with an aluminium wheel directly in front of the operator, and this is his sole duty while in the air, upon this fact being based his ability to emulate the subconsciousness of the bird in flight.



View Showing the 20-Horse-Power Motor and Position of Operator.

THE GILLESPIE AEROPLANE.

The body is suspended from the plane by means of a trussed frame of light aluminium tubing reinforced by piano wire which also serves the purpose of stiffening the wind-bearing surface and preventing any deflection under pressure.

The motive power consists of an air-cooled gasoline engine having six cylinders, opposed three to three in a horizontal plane with cranks set at an angle of 60 degrees. The machine's total weight is 150 pounds, the cylinders having a bore of 3¼ by a stroke of 3½ inches, and at 2,000 revolutions per minute it develops 20 horse-power, or an effective horse-power for every 6.15 pounds of metal.

With this power each of the propellers has shown an effective pull on a scale of 7 pounds and a fraction, or for the total number approximately 50 pounds, so that at maximum speed a lifting power of some 2,400 pounds is commanded. Complete with operator the total weight is 450 pounds.

In an article on "Guns for the Defense of the Outer Harbor," Capt. James F. Howard, United States Artillery Corps, states that of the large-caliber guns already mounted in partial completion of the project of coast defense as determined by the "Endicott Board," 93 are 12-inch, 119 are 10-inch, and 93 are 8-inch.

Correspondence.

The Invention of the Montgomery Aeroplane.

To the Editor of the Scientific American:

In the very fine account of the Montgomery aeroplane in your last issue, I take notice that I am credited as a collaborator with Prof. Montgomery in the invention of the machine. I would like to state through your columns that in this relation I have had nothing absolutely to do with it. The invention pure and simple is the work of Prof. Montgomery himself.

R. H. Bell, S. J.

Santa Clara College, Santa Clara, Cal., May 24, 1905.

The Moving Ball of Stone.

To the Editor of the Scientific American:

If the ball is of polished stone, and the base of unpolished stone, then, I think, the ball (if unfixed) would move under the influence of the heat of the sun. For the base would heat more quickly and, necessarily, cool more quickly than the ball.

But I do not think this can account for the regular motion to the south. Under the heat of the sun it would appear the motion should be a little west of south, with a possible cross rotation to the east.

If the motion be quite regular, it must be referred to some fixed physical relation between the ball and its base. If referred to the sun, its motion must vary.

F. C. Constable, M.A., Trin. Col. Cam.

Wick Court, England, May 17, 1905.

The Stone Ball.

To the Editor of the Scientific American:

The account of the stone ball's movement interests us here, as we have two similar balls which have not moved since they were placed upon their bases. One of them has been in position fourteen years. It is a polished granite, resting on a thin sheet of lead, in a saucer-like depression eight inches in diameter, on the top of the unpolished granite base. The other ball rests upon four pyramidal points about four inches high, standing twelve inches apart in a square on top of base. Both are of granite. The ball is polished. We have near the cemetery shocks from rock blasting and heavy freight railroad trains. It seems incredible that any shock short of dynamite or seismic could lift so heavy a ball nearly half an inch from its flattened disk, and roll it on its polished circumference. In this position and in its roomier basin would make more plausible various causes that have been given.

If the tables of expansion of granite by heat are correct, namely, 0.0000045 to 1 for every degree of heat (F.) then it will not account for the movement of that ball from August to April 15 of over five inches, as a variation of temperature of 20 degrees daily for 250 days, operating on the 8-inch base upon which it rests, would not altogether be more than the fractional part of an inch.

A workman of average weight on opposite sides of monument operating seven-foot levers on fulcrums four inches from the ball could readily, by a downward and slight lateral movement, lift and rotate the ball with ease. Secretary Warwick Cemetery.

Warwick, N. Y., June 1, 1905.

The Motion of a Rolling Wheel.

To the Editor of the Scientific American:

As many erroneous conclusions have been drawn from the conception of a wheel as turning about its point of contact with the rail or ground, particularly in efforts to improve the counterbalancing of locomotives, I would ask the privilege of adding some related facts to your reply to query No. 9622 in the Scientific American of April 22. There is an important difference between the condition of a body (or a part of a body) which is motionless for some interval of time and that of a body having an ever-changing velocity which is 0 at the instant under consideration. In the first instance there is no acceleration, and the body has no unbalanced force acting on it. A stone resting on the ground has the attraction of the earth just balanced by the pressure of the material on which it rests, and no unbalanced force acts. But, if the stone is thrown vertically into the air, there is a time when its formerly decreasing, upward velocity is changing to an increasing, downward velocity; and at that instant the velocity of the stone is 0. The attraction of the earth is practically unbalanced. From Newton's laws of motion it follows that, when a body has an unbalanced force acting upon it, it has an acceleration. The stone, then, has an acceleration of 32.16, even though its velocity is 0. The piston of an ideal engine, at the end of its stroke, has a velocity of 0. It does not stand still for a millionth of a second, or for any interval of time whatever; its velocity simply passes through the value 0; but it has then its maximum acceleration.

It seems to make clear the motion of a rolling wheel to consider the wheel as turning at a uniform rate about a point on its rim while that point travels over a cycloidal path. When the point touches the ground, its velocity will be passing through its 0 value, and the velocity and direction of motion of every point on the wheel will be the same as if a shaft in fixed bearings in the ground passed through the point in the rim. The point is, therefore, called the "instantaneous center." But it then has a maximum acceleration; so the *forces* acting on the wheel are totally different from what they would be if the wheel turned about the shaft assumed above.

The actual path of the center of gravity of the wheel is a straight, horizontal line if the center of gravity is at the center of the wheel, and a prolate cycloid if it is "off center." If the wheel turned about a point on the ground, the path of the center of gravity would be a circle. The radii of curvature of the two paths at any point will not be the same. Therefore, since change of motion must be proportional to the forces that produce it, we have another proof that the forces acting on the wheel would not be the same in the two cases.

Now calculations of forces and accelerations, based on a rotation about the instantaneous center, will, if the acceleration of the instantaneous center itself is taken into account, give just the same results as the simpler calculation which considers the wheel as turning on its center while the center has a motion of translation in a straight line; while any calculation which neglects the acceleration of the instantaneous center will lead to absurd results. For example, such a calculation would require that, at a speed common on passenger trains, the centrifugal force of the wheels would lift the whole train from the rails.

Waltham, Mass., May 24, 1905. G. F. Starbuck.

Can the Baalbec Stone be Moved?

To the Editor of the Scientific American:

I take advantage of an almost unprecedented rainstorm at this season in California, housing a busy man, to ask you if it would be a physical impossibility for modern mechanics to move to the shores of the New World the huge stone in the quarry at Baalbec, which evidently stumped the ancient builders of the great sun temple there. On the occasion of my visit there on horseback when completing a tour of Palestine, this was the question I brought away with me. If the ancients could quarry and put into the walls of a lofty building stones shaped and sized like box cars, passenger coaches, and the very largest Pullman sleepers, could moderns, with steam power and all the inventions of the later centuries, handle the mighty Baalbec stone? I can only give from memory approximate measurements. The stone is about 80 feet long, 18 feet wide, and 13 feet thick. It is estimated to weigh fifteen hundred tons. I can make only this contribution to the conditions of the case. When representing the United States Treasury Department, and inviting the various governments of the world to send their most wonderful achievements for exhibition at Chicago, this stone of stones fascinated my attention. From Baalbec to Beirut, from the back of a splendid Arab horse, I studied the roadway to the sea. Were the Sultan to give that mighty carved rock to America, to be put up as a tribute to the energy of a people who can build a Panama canal, there is not (or was not in 1893) a house that would need to be moved, or a tree that would need to be cut, to move the stone to a completed float. The boulevard is hard, wide, modern, splendid. The picturesque stone would interest your readers. My photograph of it is imperfect, or I would send it to you.

Edwin Sidney Williams.

Saratoga, Cal., May 26, 1905.

Ethics of the Russo-Japanese War.

To the Editor of the Scientific American:

In your excellent editorial, "An Unparalleled Victory," you attribute, with much verity, the marvelous success on land and sea to the Japanese people themselves—to certain inherent qualities and to traits of character, most admirable, acquired by training, ethical and Oriental, "older than our western civilization."

There you sound the keynote, but permit me to say that the very characteristics that you mention, viz., "intense patriotism, self-denial, scrupulous honor in all matters affecting the welfare of the state, a keen sense of duty, strict discipline, unquestioning obedience to authority, absolute unity of purpose, a firm belief in the destiny of their race, patience and endurance, an absence of self-consciousness and posing that may well put our 'white' civilization to the blush, a close attention to detail, and lastly a combination of great prudence and forethought with a marked ability to adapt themselves quickly to the circumstances of the hour," are, with one or two exceptions, common to Russian and Japanese alike.

The "Ice Palace" of St. Petersburg melts away into utter insignificance under a tropical sun. Many of the excesses of the Russian garrison at Port Arthur, on the eve of its surrender, were committed with suicidal intent. The Japanese soldiers, like the Chinese, committed suicide rather than be taken prisoners. Many Russians did the same, but not on the open field, in the face of the enemy.

Russia is not disintegrating, as a nation, an empire. Notwithstanding all internal dissension and revolutionary plots, "intense patriotism" is a trait predominant in the Russian breast. Pride of country, of race, of nationality, is strong with the Russian peasantry, who hardly could define an absolute monarchy, and who venerate the power of the Czar, their "Great Father," temporally, in much the same manner as they revere the Universal Patriarch, the head of the Greek Church, spiritually. Neither church nor state in Russia favors the education of the masses, nor their elevation in the social scale, whereas, in Japan, it is just the reverse. The national government in Japan has adopted many of the customs and progressive methods of the United States, is open to all religions, zealous for education for all classes, eager to promote the best interests of her people, intellectually, physically, materially, spiritually.

Thus it will be seen that "self-denial" is inculcated and practised by the Russian as well as the Japanese, for his country, and for his religion's sake; also "scrupulous honor," and " a keen sense of duty." But ignorance and fear are the conditions under which the Russians live and die, fight and lose; intelligence and trust those with which the Japanese win. "Strict discipline," too, we find on both sides. The discipline of the Russian army and navy is not only strict, it is brutally severe. It is systematically cruel. That is its great defect. Military plans may be well laid, the tactics of the latest and best schools may be employed; every modern device, and newest invention, and additional improvement known to any warfare be adopted, but if the discipline be too severe on the one hand or too lax on the other, the colors will go down.

"Unquestioning obedience to authority" is by no means restricted to the "Land of the Rising Sun." On the steppes of the Russias and in bleak and dreary Siberia that trait is found, is made compulsory, not in the army and navy alone, but in the home. "Absolute unity of purpose" is seldom if ever found, in frail humanity, even in this country, not to mention Russia; hence, we will concede that to the Japanese, for the present, at least.

And in Russia, as well as Japan, we find "a firm belief in the destiny of their race, patience and endurance," also. As to "an absence of self-consciousness," every soldier, of any nationality, should have that almost pre-eminently, if he is to be a good fighter and win laurels for himself. "Posing" is necessary at times, alike with rank and file. Parade drills teach that to both officers and men, even in times of peace. In battle, there must be delicate and accurate maneuvers, which require not only skill and plenty of posing and self-consciousness, but self-sacrifice, as well.

Every army knows the importance of "a close attention to detail," and that has heretofore been as marked in Russian successes as, during the entire course of this war, in their constant and successive series of defeats. We may say that the Japanese excelled the Russians in this respect, but certainly the latter were not lacking therein.

The strongest characteristic is the last, "a combination of great prudence and forethought with a marked ability to adapt themselves quickly to the circumstances of the hour." That is essentially Japanese. With marvelous rapidity they struck their blows, with unerring aim at the foe's weakest and most exposed points, meanwhile availing themselves of the best strategic bases of operation.

The Japanese in every engagement seemed to possess a hidden insight, not only "forethought," but foreknowledge of all the enemy's plans and positions. The Russians took every precaution, as they thought, to protect themselves from traitors within their own ranks, and from Japanese spies; but the result was always the same. The intelligence was conveyed from one to another with Oriental rapidity. But the Japanese did not rely upon such intelligence alone. From the Occident, they had previously fortified themselves with the best munitions of war, they had acquired materials and resources and financial backing, of which the world at large knew nothing. Mrs. Edward P. Foster.

Cincinnati, Ohio, June 14, 1905.

The Current Supplement.

The petroleum and coal fields of the Pacific coast of Alaska is the subject of the opening article in the current Supplement, No. 1538. Dr. Richard Lucas writes briefly but instructively on the Coloration of Glass by exposure to the light. How a vertical sun-dial can be made is very exhaustively described and illustrated in a well-written article. Why is the silica brick better than the clay brick? An answer to the question will be found in an authoritative discussion of the subject. The Hammurabi Code is without doubt the earliest legal document extant. In the Supplement a splendid comparison of this ancient code with the Code of the Covenant, with which it has much in common, is drawn by Prof. Max Kellner. Dr. E. Branly, whose name will be forever linked with the invention and commercial introduction of wireless telegraphy, writes on an Experimental Study of Electric Waves and Their Applications.

Cultivation of Chicory in Belgium.

During the months of January, February, and March attention is attracted to the immense quantity of a special vegetable sold by marketmen, greengrocers, and hucksters, and eaten by all classes throughout Belgium, prepared in various appetizing manners, and frequently eaten as a salad, either raw or cooked. I refer to the white chicory, the cultivation of which is a specialty of Brussels and its suburbs.

There are two species of chicory grown in Belgium. The wild chicory (*Chichorium intybus*) is cultivated in the neighborhood of Roulers, Thourout, and one or two other localities, in close proximity to the chicory manufactories, where the roots of the plants are parched, ground, and sold loose or in half-pound packages, to be used in connection with coffee, especially by the working classes.

The white chicory was originally brought to Belgium from India, and the principal center of cultivation is in the immediate neighborhood of Brussels, especially in Schaerbeek, Evere, and Woluwe. The root of this plant is of inferior quality and is consequently used as cattle feed.

The growing of this essentially winter vegetable requires great care, trouble, and hard work, beginning early in April, when the seed is sown. As soon as the plants are an inch or two high they are carefully thinned out by hand, leaving the most vigorous undisturbed a given distance apart. In September and October, when the plants are in full maturity and the leaves very long, they are taken out of the ground and the leaves carefully cut off about two inches from the root. Trenches are prepared, and the plants are disposed in them in three layers, each layer being covered by 10 inches of earth and from 12 to 14 inches of horse manure. This manure produces an artificial heat, which causes the chicory to sprout, and the earth being compactly pressed upon the plants, the leaves adhere closely together, and as no sunlight penetrates the covering, the plants are bleached white and present a most attractive and appetizing appearance when removed for consumption. This is done according to the demands of the market. The vegetable is available all the year round, but the most active demand is in the months of January, February, and March, during the scarcity of other garden vegetables.

The above-described method of bleaching chicory has existed since the commencement of the cultivation of this popular vegetable, but much complaint is heard concerning it, principally on account of the germs contained in the horse manure, which is likely to render the vegetable unwholesome and unfit for consumption, and also on account of the danger of a sudden frost, which, by lowering the temperature of the manure covering, checks the growth of the plants and correspondingly affects the selling price. To combat these inconveniences the cultivators of chicory at Schaerbeek, one of the most important suburbs of Brussels, have for some time been experimenting—heating the layers of plants by the system of thermo-siphons. The system has the advantage of giving a regular, constant heat, and greatly reduces the manual labor connected with the cultivation.

Although an immense quantity of chicory is consumed in Belgium, the yield is sufficient to supply Paris with large quantities, where it is largely used in the hospitals of that city. The average wholesale selling price in Belgium is 7 cents per kilogramme (2.20 pounds), and in Paris from 14 to 16 cents. To perform all the different operations connected with chicory growing demands hard work and constant attention. The most dangerous part of the work is the loading and transportation of manure, which has to be done before 8 o'clock in the morning. The great differences in the temperature of the cavalry and other stables, where the horse manure is obtained, and the temperature of the outside cold and chilly morning air frequently results fatally to the men employed in this work.—Geo. W. Roosevelt, Consul, Brussels, Belgium.

Modern industry, by improving and multiplying its methods of action, has increased the danger for the operative, who depends for his livelihood on his daily labor. Machinery, to-day replacing and decupling human force, constitutes not only an admirable source of production, but also a terrible source of danger. An industrial establishment, as has been said correctly, is a battlefield, having, like war, its victims, some mortally attacked, others more or less grievously wounded, and for a longer or shorter period rendered incapable of providing for their personal needs. The legislator should not be indifferent to these misfortunes. One of his prime duties is to prevent or mitigate their effects as far as possible. M. Riard says these things in La Revue Technique.

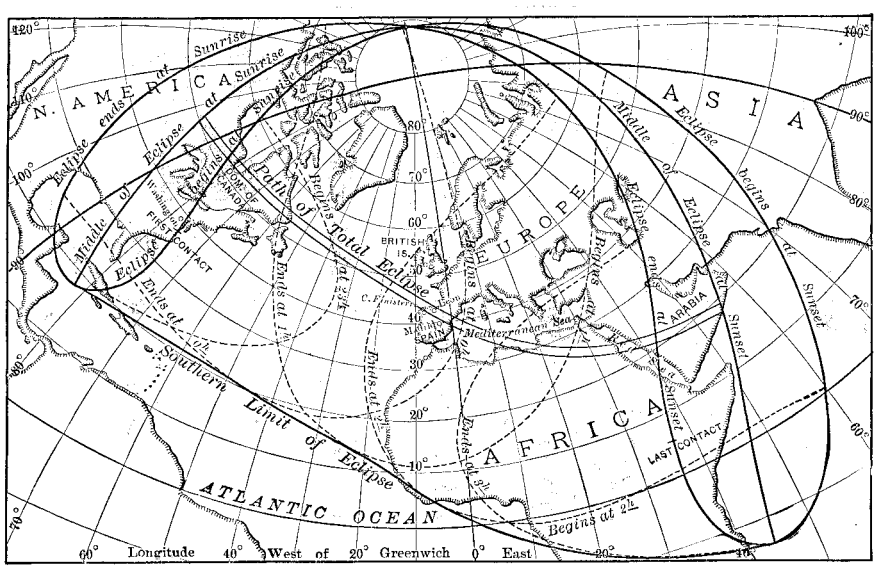
THE UNITED STATES NAVAL OBSERVATORY ECLIPSE EXPEDITION.

BY C. H. CLAUDY.

An eclipse of the sun, visible in part to the greater area of North America, Europe, Africa, and Asia, will take place on August 30, 1905. The eclipse is total to parts of Canada, Atlantic Ocean, Spain, the Mediterranean Sea, Africa, the Red Sea, and Arabia. To observe the phenomena attendant upon the total eclipse of the sun, the United States naval observatory is equipping three expeditions to go to Spain and Africa.

The exact locality in which the three expeditions will locate has not been absolutely determined, but it is probable that the two parties who go to Spain will station themselves on the central line of the eclipse near Burgos, and near Sagunto. The African party will in all probability locate at Sauk Ahauras, Africa.

The equipment of the parties has been a matter of deep thought and much work to the observatory officials. Experiences in the past have proved that, other things being equal, the best equipment yields the best results, and that carelessness in equipment means an irreparable loss. For the time of totality is very short, and all the work which is done on the total eclipse phenomena must be accomplished, in this instance, within the limits of three minutes and forty seconds at Burgos, two minutes and twenty-nine seconds at Sagunto, and three minutes and thirty-four seconds at Sauk Ahauras. Naturally, the apparatus must be as perfect as ingenuity and skill can make it, and the men operating it drilled in every movement, in order that everything may go off without a hitch, and that the maximum amount of photographs be taken in the allotted time. Unlike the eclipse expeditions of several years back, almost all the work done, both telescopic and spectroscopic, is now accomplished with the camera as the most important part of the outfit. Photographs taken during the hurried work can be studied at leisure and are at once more accurate and more reliable than visual observations and the most painstaking drawings. Of course, the camera cannot record the colors, but that is about its only limit.



PATH OF THE ECLIPSE OF AUGUST 30, 1905.

Taking up each party in turn, the equipment is as follows:

For Party No. 1, which will go to Burgos, there is provided, first a stationary camera provided with a 40-foot focus lens of 5 inches diameter, which produces the image of the sun on a 14 x 17 plate. A more detailed description of this instrument will follow. Next is a polar axis, on which is mounted a camera with an 8½-inch lens of 12 feet focus, using 11 x 14-inch plates, and a 6-inch Dallmeyer lens of 36 inches focus, both of which are for photographing the extensions of the corona. This polar axis will also carry a spectroscopic camera. The stationary camera uses a cœlostat (a device in which a mirror, run by clockwork, keeps an image of the sun in one position as the earth moves under it), and upon the other end of the shaft carrying the mirror will be a plane-grating spectroscope, with a 5-inch aperture and 72-inch focus lens, taking photographs on plates 14 x 1½ inches. It is expected to make at least twelve exposures with this instrument during totality. Dr. S. A. Mitchell, of Columbia University, New York city, will be in charge of the spectroscopic work at this station, and besides using the instrument just described, will have, in addition, a cœlostat used on one of the old transit-of-Venus expeditions to which will be attached a parabolic grating spectroscope.

Station No. 2, near Valencia, Spain, will have the giant camera of the three expeditions, which is illustrated herewith. It is 65 feet long and has a lens triple achromatic, made by Brashear after curves computed by Prof. C. S. Hastings, of Yale. The lens is 7½ inches in diameter and produces an image of the sun 7 inches in diameter. Next in the equipment of this station comes a polar axis, on which is mounted a camera provided with a 6-inch lens, of 104-inch focus, and using 8 x 10 plates. This camera is provided with a color screen, and, like the cameras on the various polar axes, is for work on the outer corona. On this axis will be a 21-foot concave grating spectroscope, used direct.

The third party, in Africa, will be provided with a camera containing a lens of 5 inches diameter and 40 feet focus, a polar axis, and on it a camera with a lens 9.6 inches in diameter and of 14-feet focus, for 11 x 14 plates, and a 10-foot spectrograph pointed directly at the sun. This party also will have a transit-of-Venus cœlostat and a new instrument, termed the chronospectrograph, which will give a continuous spectrum with indicated time, in seconds, during the time of totality. Prof. L. E. Jewell, of Johns Hopkins University, will be in charge of the spectroscopic work of this party.

If the illustration of the big camera herewith printed is examined, it will be seen that it is composed of a series of wooden frames, ending in a little house. This house is knock-down and portable, and contains a double door, so that members of the party may enter and leave it without admitting light. It has no windows, but the roof lifts up to allow ventilation and light when desired. It was photographed while set up in the Observatory grounds, where it was being tested. The thoughtful reader will at once inquire why, if the frames are made at all, they are not covered? The answer lies in the fact that for testing the action of the cœlostat and the working of the plate holder, etc., experimental photographs are taken with a focal plane shutter, of the sun as it is. The exposure is less than a thousandth part of a second, and what little light can get through the small opening of the two covered sections in that time is immaterial. When the sun is in eclipse, however, the exposure will be much greater, possibly thirty seconds. Hence the need of an instrument which will keep the sun still, in reference to the plate, and the covering, to exclude every bit of extraneous light.

The cœlostat on this instrument is one which the Observatory has had and used before. The cœlostats for the other two long-focus cameras, however, are new. They were designed by Mr. W. W. Dinwiddie of the Observatory staff, and made by William Gaertner, of Chicago. They are at once simpler, lighter, and much less expensive than any similar instruments ever carried on an eclipse expedition. Another illustration shows one of these cœlostats being tested by its designer. The cœlostat is simply a polar axis, a means for revolving it in the opposite direction to the earth's movement at a speed equal to that of the earth about its axis, and a mirror on one end of this axis. When the mirror is so adjusted that the rays of the sun fall in any one particular spot, and the clockwork set in motion, the rays of the sun continue to fall on that selected spot, for as fast as the earth carries the spot away from the place of reflection, the mirror alters its position so that the rays follow the spot. In this case, of course, the spot is the target placed over the sensitive plate in the end of the camera.

The polar axes are, as seen in the illustrations, simply triangular frames, which support a trussed structure forming the axis. This trussed structure has attached to it another trussed structure, which, when covered, and provided with a lens and plate holder, forms a camera, adapted to follow the sun as the earth turns upon its axis. These cameras, having a focus of from 12 to 15 feet, yield a much smaller image of the sun than do the huge stationary cameras of from 40 to 65 feet focal length. The smaller cameras, therefore, are adapted to picture the eclipse and all the coronal prominences and streamers. The larger cameras are devised to make large pictures of the sun and devote their particular attention altogether to the phenomena in the immediate vicinity of the sun. The polar axes also carry the spectroscopic apparatus, for making spectrographic photographs. The means by which the clock motion is transmitted to these polar axes is extremely interesting, as being so simple. As seen in the illustration, the clockwork, which is in the metal case in the foreground, is connected to the instrument by a horizontal shaft. This shaft meshes, by means of cogs, with a drum, around which passes a small wire cord. This cord is supported, on the right, by an idle drum, and on each end of the cord is a weight. As the shaft turns, the cord moves, and when, by means of a clamp, the truss rod which leads to the polar axis is connected to the cord, the polar axis will move in an opposite direction to the cord. The clamp, which connects the connecting rod with the cord, allows the polar axis to be set, within sufficient limits for the short period wanted for photographing the eclipse, at any desired position. The whole thing has the merit of simplicity and strength, and can stand weather,

while at the same time it is, for all intents and purposes, absolutely accurate. Even supposing there exists a slight error in the rate of the clock, which should escape the vigilant tests made for such aberrations, the error would be small for a day's journey of the sun across the sky, and for a period of a few seconds would be *nil*. Nevertheless, no errors not known, and so to be accounted for, will exist if careful testing, both before shipment and after it is set up on the ground at the eclipse station, can help it. The illustration showing the three polar axes, in different stages of completion, also shows an observer testing, with a small telescope and micrometer, for periodic errors in the clockwork. Many observations are taken of the actual rate of the clock, and the mean compared with the known rate of the earth's motion. The error, if error there is, is obviously easily detected.

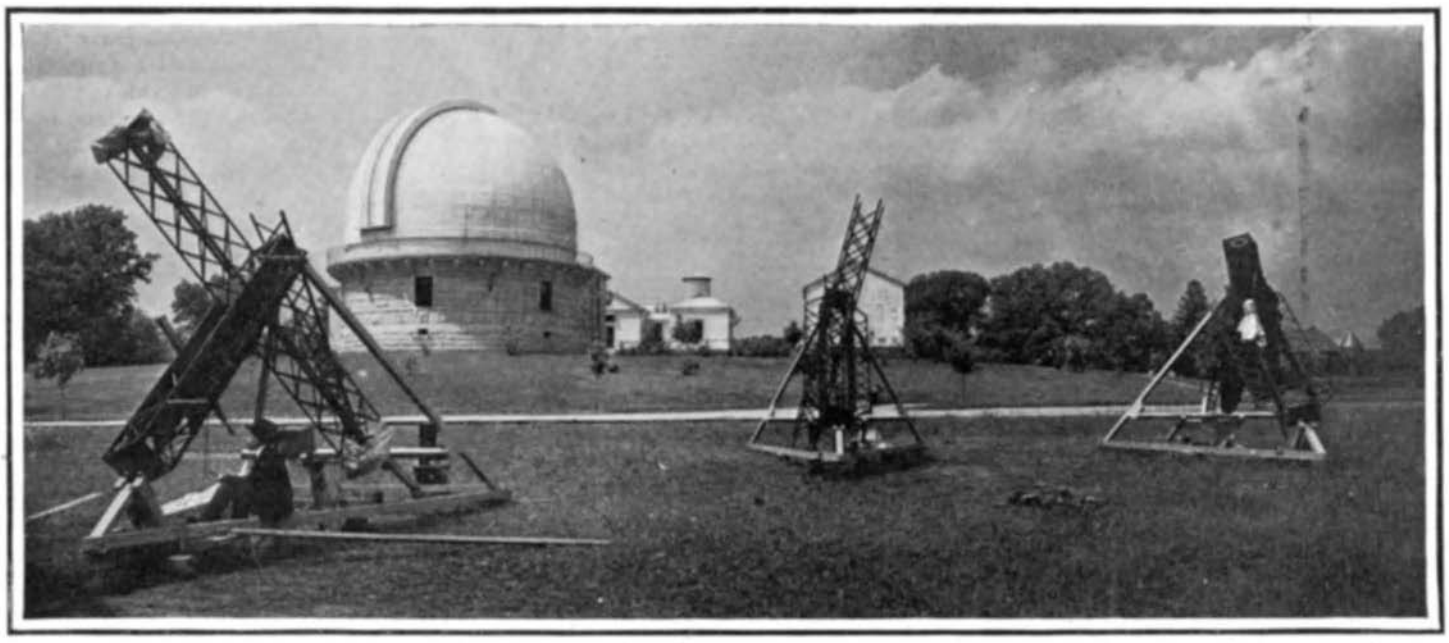
It will be noticed that these polar axes, as well as the big cameras, are all of such construction that they may be taken to pieces and put together easily. It is necessary to ship all the instruments very carefully, and to have them packed with the greatest nicety. To this end everything comes to pieces and is packed in boxes specially made for the purpose; and to guard against possible damage, every part of the delicate instruments, such as clockwork, axes, lenses, shutters, etc., is wedged into specially built compartments in the boxes.

Besides the instruments mentioned, each party will have a large portable transit, for determining latitude and longitude and for setting the instruments, and distributed among the parties are five 5-inch portable equatorial telescopes, for visual observations.

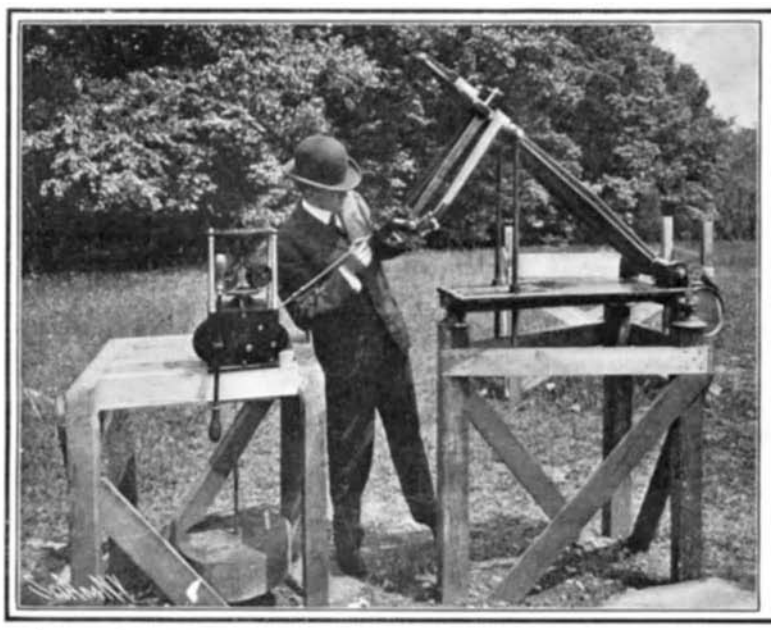
As far as determined, the personnel of the parties is as follows, all under the general direction of Admiral Chester, who is at the head of the Observatory:

First party: Prof. W. S. Eichelberger, Mr. E. I. Yowell, Dr. S. A. Mitchell. Second party: Prof. F. B. Littell, Mr. George A. Hill, Mr. G. H. Peters, Commander Hayden in charge. Third party: W. W. Dinwiddie, Prof. L. E. Jewell, Capt. Norris in charge.

The instruments have been largely made at the Observatory, and many of them were designed by Mr. Dinwiddie. He is responsible for the two new cœlostats, the three portable dark-rooms, the three portable houses which are the ends of the big cameras, the three polar axes, and the chronospectrograph, besides the 10-foot concave grating spectrograph. The parties and their equipment will start from Alexandria, Va., on the U. S. N. collier "Cæsar," about June 15 or 20. Arriving at their stations, the instruments will be immediately set up and tested, and when in perfect running order the members of the party will drill daily until all are letter-perfect in the actions that each is to perform. So much attention is paid to the details of the drilling, in order to have every man perfect, that dummy glass-plates, for the big cameras, are carried, with ground edges to prevent accidents. These big plates are handled naked, and as everything depends upon getting them into the holder in the portable house, exposed, out of the holder, and put away, and another one in place, with the utmost dispatch, the importance of this provision is at once seen. As the entire party is divided into three stations, there seems to be a good chance of good results. The only thing to fear in the weather line is thunder-storms, and should three thunder-storms occur at the three different stations at the time of the eclipse, the laws of chance would stand in serious need of revision. Inasmuch as the equipment is superior to any heretofore carried on such an expedition, and long experience in such work is behind the various members of the parties, much is looked for in the way of new data concerning the many only slightly understood phenomena of a solar eclipse. No eclipse has ever been photographed with the thoroughness with which this one will be; naturally superior pictures are looked for. Beside the expedition of the Naval Observatory, almost every prominent astronomical observatory in the world will send out parties. Many private expeditions are also bound for Spain and Africa to view the eclipse.

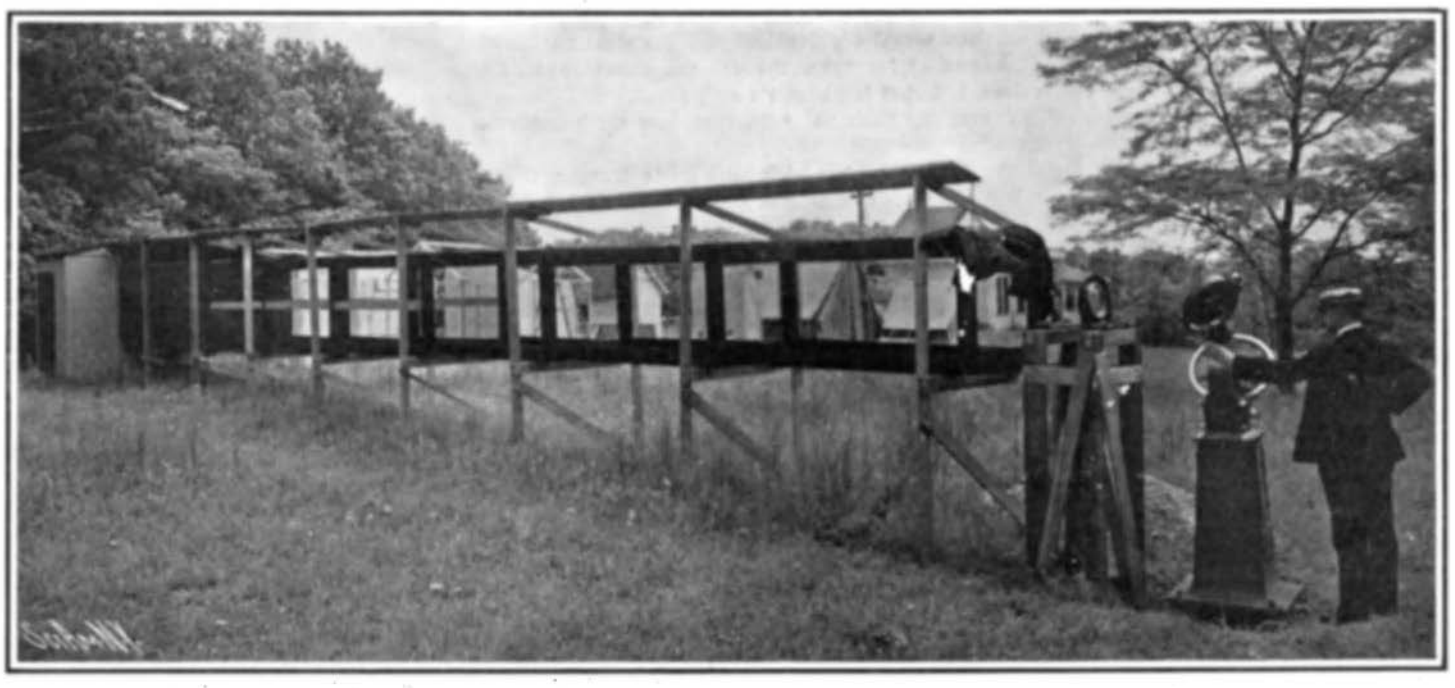


The Three Polar Axes in Different Stages of Completion, Set up for Clock Tests in the Naval Observatory Grounds.



Mr. Dinwiddie Examining His Coelostat. This Instrument is One of Two Built for the Coming Eclipse.

One of the Polar Axes with Camera Mounted and Temporarily Covered for Testing.



A Sixty-Five Foot Camera Erected for Tests in the Naval Obervatory Grounds.

THE UNITED STATES NAVAL OBSERVATORY ECLIPSE EXPEDITION.

A recent invention renders the barrels of both firearms and pneumatic guns thoroughly rust-proof, durable, and cleanable by the use of a rifled glass lining. The gun barrel comprises an outer shell of usual gun metal, which may be cylindrical or octagonal or any other shape. The bore of the barrel at the rear end is increased in diameter, to form the firing chamber, in which the shell of the cartridge is received, and from the forward end of this chamber to the nozzle of the barrel is a lining of glass, which has any desired thickness and the requisite toughness. The position of the glass lining is such that the products of combustion do not come in contact with any metal surface but only with the glass. The glass is rifled throughout its length, so as to give the projectile its proper rotation. Some expert opinion may question whether the process can be of more than speculative value, yet the invention is made attractive at least by its originality.

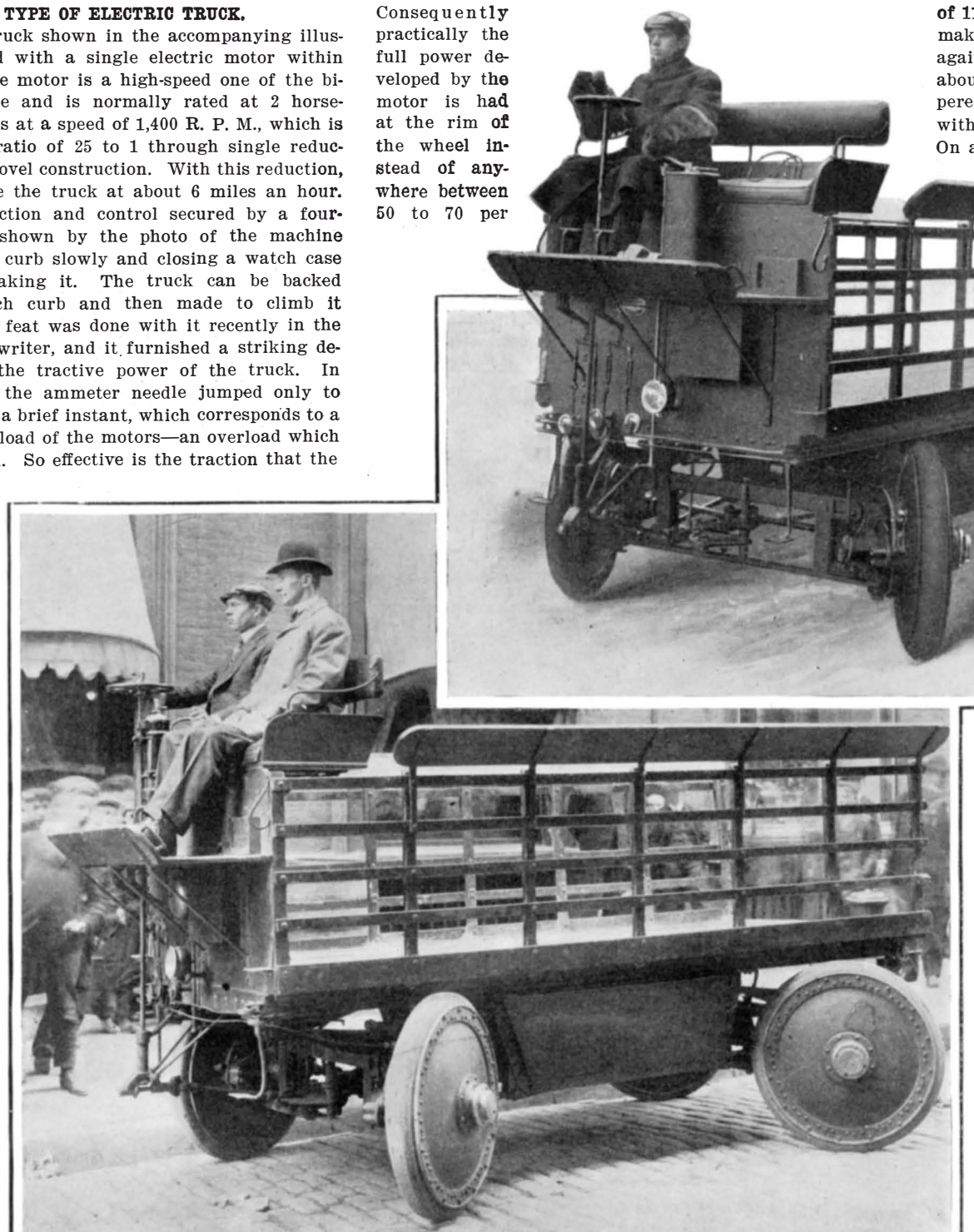
NEW TYPE OF ELECTRIC TRUCK.

The electric truck shown in the accompanying illustrations is fitted with a single electric motor within each wheel. The motor is a high-speed one of the bipolar series type and is normally rated at 2 horsepower. It rotates at a speed of 1,400 R. P. M., which is reduced in the ratio of 25 to 1 through single reduction gearing of novel construction. With this reduction, the motors drive the truck at about 6 miles an hour.

The great traction and control secured by a four-wheel drive is shown by the photo of the machine dropping off the curb slowly and closing a watch case lid without breaking it. The truck can be backed against a 12-inch curb and then made to climb it from rest. This feat was done with it recently in the presence of the writer, and it furnished a striking demonstration of the tractive power of the truck. In doing this feat, the ammeter needle jumped only to the 150 point for a brief instant, which corresponds to a 100 per cent overload of the motors—an overload which is never exceeded. So effective is the traction that the truck was able to pull stalled horse-drawn trucks out of the snow last winter, even when equipped with steel tires.

The appearance of the interior of the truck wheel and the manner in which it is driven by the pinions on the armature shaft of the motor are made apparent by a glance at the views showing the wheel open and looking down upon it, with rim removed.

As can be readily seen, the frame that carries the field magnets terminates at one end in a hollow spindle which carries a roller bearing for the wheel and through which pass the wires for conveying current to the motor. The armature is placed horizontally and practically parallel with the plane of the wheel. It carries a bevel pinion on each end of its shaft. These two pinions mesh respectively with two gear rings which face each other and are attached to the hub of the wheel. The thrust of one pinion against the opposing ring is counterbalanced by that of the other pinion against the ring that faces it, so that a couple is formed, with the result that there is little or no thrust upon the wheel motor bearings. So much is the friction reduced by this arrangement, that the transmission loss from motor to wheel with a speed reduction of 14 to 1 has been found to be only 1 per cent with as high as a 16 per cent overload, while in the truck we illustrate it does not exceed 3 per cent. Consequently practically the full power developed by the motor is had at the rim of the wheel instead of anywhere between 50 to 70 per cent of this power, as is the case with the usual spur gear, double reduction transmissions usually employed. In order to allow for any wear and so as to always be certain that the application of power to the wheel is equally divided between the two pinions, each motor is fitted with an equalizing device that accomplishes this result.



Turning Position with the Front and Rear Wheels Following the Arc of a Circle.

Turning the Truck with all Four Wheels Parallel.

NEW TYPE OF ELECTRIC TRUCK.

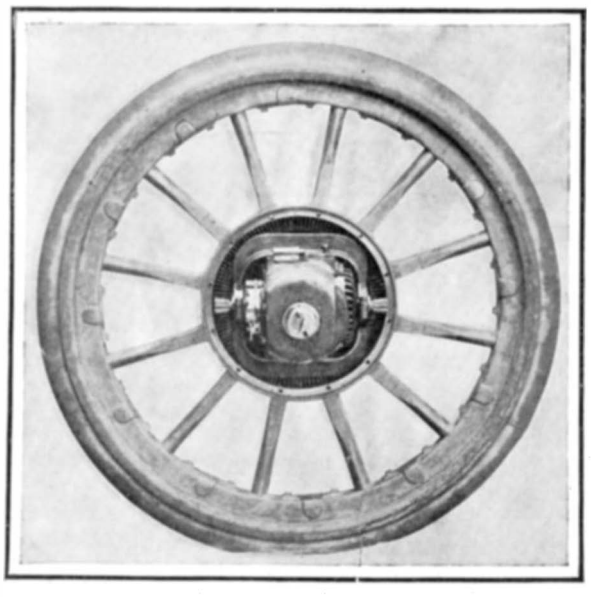
The controller used on the truck is of the usual trolley-car type. The diagrams show the connections made at the motors and controller to obtain the five speeds in either direction. In starting, each pair of motors is connected in series through half of the battery. For the second speed the armatures are kept in series and the fields are placed in parallel. On the third speed the motors are in parallel on half the battery. The fourth speed finds the fields in parallel and armatures in series on the whole battery of 42 cells, while on the fifth speed the motors are in parallel on the whole battery. The fourth speed gives the maximum torque and is the regular running speed.

On account of the great saving in transmission of power to the wheel through the single reduction couple-action gear, the 3 to 5-ton truck shown, whose weight complete is 7,700 pounds, will run on some 30 per cent less current than the ordinary truck of the same size. The result is that the battery and motors will last much longer than is usually the case, as they are never seriously overloaded. Under regular service conditions, about 3,000 miles can be got out of the battery before it will need cleaning. An examination of the motors by the editor of this journal showed them to be in very good condition, there being, apparently, no trouble from burning of the commutators due to jumping of the brushes from the excessive vibrations the motors would be expected to receive in the wheels. The tension on the brush holder springs, too, was very light.

Some tests made recently in New York city show the economy of the new truck under severe hill-climbing conditions. The hill at Ninety-first Street and Lexington Avenue, which is paved with cobblestone and has a 15 per cent grade, was mounted with the controller on the fourth speed with a current consumption of 112½ amperes at 75½ volts. The time taken in making the climb was 2 minutes 40 seconds, as against 1½ minutes when running empty (weight about 8,200 pounds) on a consumption of 68 amperes at 80 volts. The total horse-power developed with the 4-ton load was 11.37, and without it 7.15. On a level road the truck has carried 3½ tons at about 5½ miles an hour (fourth speed) on but 42½ amperes at 80 to 84 volts (5½ horse-power). The current and voltage used in the hill-climbing test were accurately measured by two separate sets of recently calibrated Weston instruments, so the observations are probably quite accurate. An ordinary two-motor truck, although capable of ascending a 15 per cent grade nearly twice as fast, consumes about three times as much current, and the heavy discharge rate soon ruins the battery.

The truck uses about 200 watts per ton-mile, where the ordinary one-ton delivery wagon consumes 475.

An examination of the pinions and bearings is said to have shown almost no perceptible wear after running the truck nearly 4,000 miles. When cost of maintenance is considered, therefore, it would appear that this electric truck would be considerably cheaper to run and maintain than a gasoline truck of equal size.

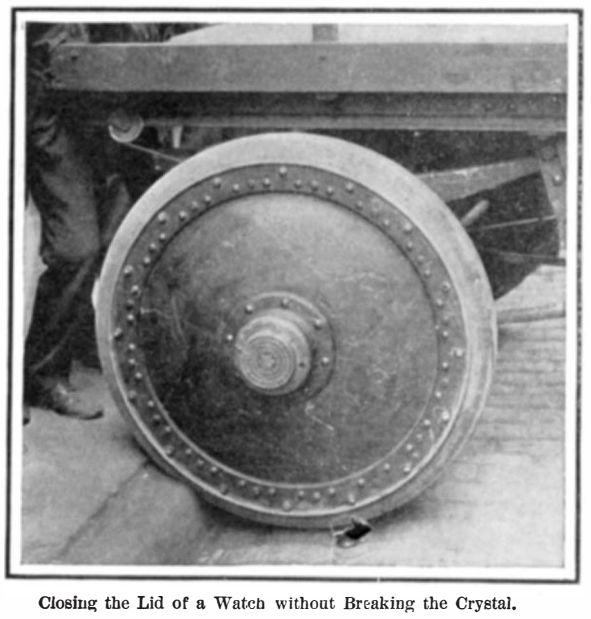


Type of Wheel Used for Light Vehicles.

The Manufacture of Cellulose from Cornstalks.

BY C. M. GINTHER.

After extensive and elaborate experiments by the government, it has been discovered that cellulose in considerable quantities may be extracted from corn stalks, and the industry promises to grow to gigantic proportions almost at once. Cellulose, as is well known, is the essential constituent of the framework or wall-membrane of all plant cells. It is a secretion from the contained protoplasm, but in the advancing growth of the plant the walls become incrusted with resin, coloring-matter, etc. It composes the cells of wood as wax composes the cells of a honeycomb. Cellulose, by reason of its peculiar properties, is being largely introduced into shipbuilding, as due to its property of swelling rapidly when wet, it prevents leakage through holes below the waterline. Up to the present century the only available material from which cellulose for this purpose could be prepared in sufficient quantities was the cocoanut shell. The ground fiber of the cocoanut shell with a small percentage of the original fiber constituted the cellulose of commerce.



Closing the Lid of a Watch without Breaking the Crystal.

Perfect Motor Control.

This wonderful material possesses the property of swelling rapidly when wet and is very light. It is practically free from danger of fire, burning very slowly, and with great difficulty when compressed. In France experiments made by firing a 10-inch shot through a mattress of cellulose demonstrated that the fibers came together and swelled so rapidly that only three gallons of water passed through the aperture, and in a short time the hole was closed entirely. Cellulose was first used in shipbuilding in 1884, but it obtained favor so rapidly that in 1890 the French introduced it into some forty vessels of their navy, and in the same year its use was ordered as a means of protection in the construction of ships in Russia, Holland, Japan and Greece, as well as in the American navy. It was soon demonstrated that the supply of cocoanuts in the world was far too small to furnish the cellulose demanded for warships alone, and search was made for a more plentiful and cheaper material. The Cramp Shipbuilding Company spent years in trying to find a substance that would serve the same purpose, and at last discovered it in such abundance that the question of supply was forever settled. Cornstalk, which the farmer has been throwing away as waste, was found to contain in its pith the very best material in the world for making cellulose. Almost immediately arrangements were made to build large factories in different parts of the country where corn was the staple crop. Three such factories have already been established in this country, and two in Europe. This corn pith, for ages considered worthless, has been found to contain not only cellulose to be used for protecting ironclad vessels, and preventing them from sinking in case their shell is punctured below the waterline, but also from it can be made smokeless powder, dynamite, and other high explosives, fine art paper, varnish, kodak films, car-box packing, filler, waterproof cloth, linoleum, imitation silk, patent leather finish, face powder, silicate packing, and a hundred other by-products the despised cornstalk was never dreamed to contain. The outer lining, that which contains the pith, is made into a substance which is used to adulterate flour, also as a cattle food, a poultry fattener, and egg producer. Some of it will be made up into candy, part into coloring dyes, and other properties have been discovered which make it one of the most useful substances the earth produces. It will add thousands of dollars to the crop receipts of farmers, which is almost entirely clear gain, since the product utilized is only that which was considered worthless.

The annual average corn area of the United States is not far from 80,000,000 acres. Each acre yields on an average about 4,000 pounds of cornstalks, or a total of 160,000,000 tons. Of this weight 85 per cent, or 136,000,000 tons, has value as feed, but not over 10 per cent of it is actually fed. The other 15 per cent of the total weight, or 24,000,000 tons, is the pith of the stalk, which has been a total loss, or even worse, since it required labor to dispose of it. One company pays $3 a ton for the stalks, and produces a material which is worth 17 cents a pound, or $340 a ton. It has been figured that every ton of cornstalks in the country could be so handled that it would increase the value of each corn crop $480,000,000 annually.

The "Kearsarge," the "Kentucky," the "Indiana," the "Illinois," and all the new war vessels that this country and all other nations are putting on the seas, have a double armament around the waterline, underneath the heavy Harveyized steel plates. It is composed of cellulose from corn pith, and is six feet in thickness. In the late Chinese-Japanese war the value of cellulose jackets under the steel was demonstrated in a very startling manner. In one battle two Chinese men-of-war were sunk by Japanese balls penetrating below the waterline and allowing the water to rush in and sink the ships; in the same battle one of the largest Japanese ships was struck below the waterline. The shot passed through a jacket of cellulose, which instantly swelled upon the water striking it, and closed the hole entirely. It is said that not a drop of water penetrated into the hold of the vessel. The ship continued in the fight, and afterward leisurely proceeded to dock, where the injury was repaired. Corn pith will hold twenty times its own weight of water, absorbing it like a sponge, and expanding over sixteen times its compressed bulk. These properties of swelling and absorbing water make it superior to any other substance for a like purpose known. The process of manufacture is elaborate. The stalks are cut, broken, and mashed, and then by a series of elevators and suction pipes, the stalks are screened and separated and disposed into various receptacles and treated chemically. Stalks of one crop are stacked and stored and permitted to sweat and dry over winter. After six or eight months they are thoroughly dry and ready to be taken into the factory. They are now cut into pieces one inch in length and then shaken, to cause the pith to fall out. After the stalks are cut they are not touched by the workmen again, all the rest of the process of manufacture being accomplished by automatic machinery. The pith is finally chemically treated, compressed to one-sixteenth in bulk, and made into blocks six inches square. The chemical treatment makes them fire-proof. The government into whose ships the cellulose in process of manufacture is to be placed always has a representative present to inspect the process of manufacture and to subject the material to various tests to insure its quality. Among other tests, each block of cellulose is subjected to a heat of one thousand degrees, and if it does more than merely sear, it is rejected. The blocks are then packed into waterproof boxes and shipped.

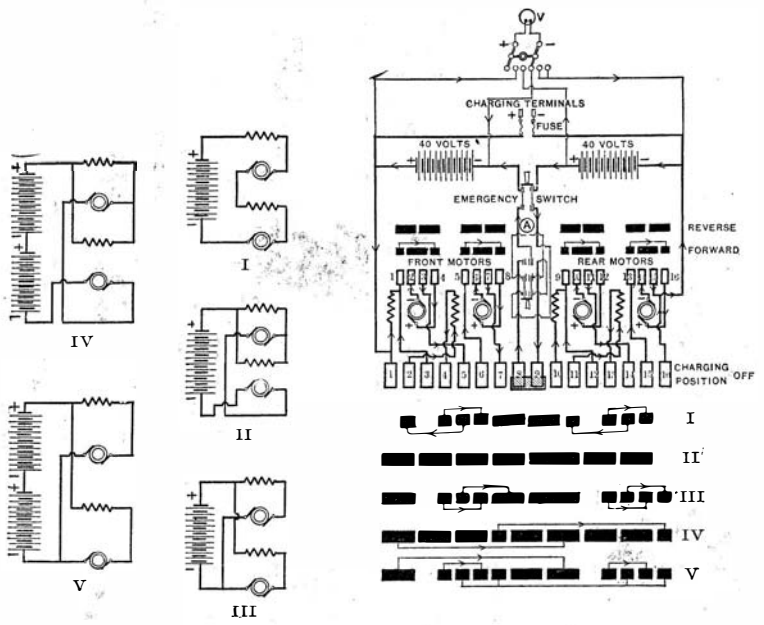
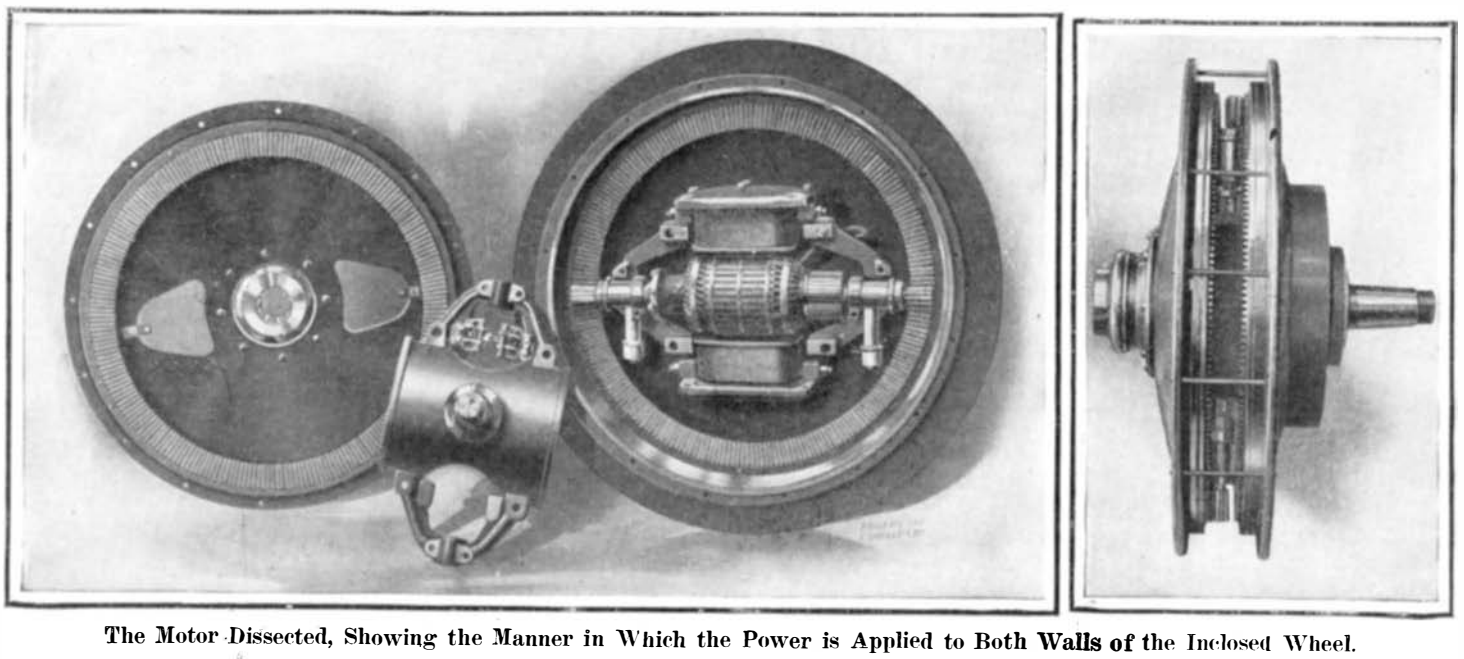


Diagram of the Controller Connections.

Duc d'Orleans Polar Expedition.

The steamer Belgica with the Duc d'Orleans on board sailed May 24 for Tromsoe on her way to the Arctic regions, where it is said the duke will attempt to communicate with the Ziegler expedition, headed by Mr. Anthony Fiala, of Brooklyn, N. Y.

The whaling steamer Belgica, recently purchased and provisioned for two years by the Duc d'Orleans, made a voyage to the Antarctic regions with a Belgian expedition in 1897, returning in 1899. The captain, the crew, and the scientific staff have each of them had experience in Arctic exploration. The duke will take charge of the naturalists' department.



The Motor Dissected, Showing the Manner in Which the Power is Applied to Both Walls of the Inclosed Wheel.

NEW TYPE OF ELECTRIC TRUCK.

Electrically-Operated Switches and Signals.

At the London terminus of the London and North-Western Railroad, an installation for the operation of the semaphores, switches, and crossovers by electric power is being carried out. The system adopted is the invention of one of the engineers to the railroad. The power is to be drawn from a generating station capable of supplying 700 horse-power. The heavy traffic at this terminus requires incessant backing of arrival trains into sidetracks, and the rapidity with which the movements of the switches and signals controlling these operations has to be performed, rendered the manual method impracticable. The operation of the electrical system is as follows: When the signalman moves a lever controlling a crossover or signal, the action becomes locked halfway; the movement transmits an electric current to the switch, and a small electric motor draws it over and then becomes disengaged. Simultaneously, a current returns to the cabin, and releases the locked lever, which can then be fully drawn over, a movement which assures the signalman that the crossover has been completely moved and is ready for the approaching train. The half-way stoppage of a lever on being first moved, which remains so until the electric current drawing together the crossover returns to notify that they have finally closed and thereupon releases the particular lever, is a protection against the signal lever being moved until the connection is complete. Any defect in the crossover, or any obstruction, such as earth, pieces of wood or other substance intercepting their proper closing, keeps the connecting lever in the cabin locked half-way and the signal at danger until the fault is rectified. A further safeguard is found in the action of the levers, which operate the signals governing the crossover so moved. The signal lever can be fully pulled over at once, and the signal is thereby instantly moved to the "all-right position," an electric current again having been sent and energized a magnet operating the signal. This current, however, does not go direct, but passes through a switch which is opened and closed by the crossovers, and if these have not moved correctly or are not actually bolted, the current to the signal is stopped, and the latter remains at danger. After the train has passed, the lever working the signal is moved back, and the signal arm, by gravity, instantly returns to the danger position. If it does not, the signalman instantly knows it, as a further check is provided by the lever then becoming locked halfway. It is only by the complete movement of the lever that the operator knows the signal has reverted to danger.

The object of the water-tube boiler is to reduce weights, give greater safety against explosion, greater rapidity of raising steam, and an increase of economy in the generation of steam. The various makes of water-tube boilers are too numerous to mention, but they divide themselves into two broad, general classes—those with straight tubes of large diameter, say four inches; and those with curved tubes of small diameter, from an inch to an inch and a half. Probably no single boiler possesses all the merits which a perfect water-tube boiler should have, and in nearly every case the attempt to secure certain advantages brings attendant disadvantages, and *vice versa*. The large straight-tube boilers are not so light as the ones with small tubes; and it is more difficult to secure adequate economy, which is dependent largely upon skillful baffling. They do not permit of such rapid raising of steam from cold water as the smaller tube boilers, because, like the Scotch boiler, they carry a large reserve supply of water in the boiler after the manner of the Babcock & Wilcox boiler. On the other hand, they permit the replacement of a defective tube and of the cleaning of a tube much more readily than the tubes which are bent. Likewise it is only necesary to carry one size of spare tubes, while the bent tube boilers require several.

RECENTLY PATENTED INVENTIONS.

Of General Interest.

OIL-PRESS MAT.—R. F. WERK, New Orleans, La. The object in view in the present invention is the production of a hair mat or cloth for use in oil-presses which is capable of a certain amount of pliability in a longitudinal direction, whereby the formation of a cake of the compressed material is facilitated. The parts are arranged to afford protection to weft-threads, to reduce tendency of selvage to unravel, and to enable the mat to be folded longitudinally at any line without breaking or giving way in threads or strands. This inventor has secured another patent on an oil-press mat. It is made of animal hair by weaving together threads or strands in a well-known manner; and the distinguishing feature resides in warp-threads made of soft hair. This overcomes the great difficulty, a liability to unravel. The desired strength and durability of the mat are secured by use of hard, stiff, and coarse hair in the production of weft-threads. Both improvements are divisions of earlier applications for Letters Patent filed by Mr. Werk.

LATCH AND LOCK.—C. A. PRESCOTT, Victoria, Canada. The improvement refers to insertible or mortise locks adapted to serve the dual purpose of a door lock and latch, and has for its objects to provide novel details of construction for a combined door lock and latch which are simple and inexpensive and that adapt the same for convenient application upon a door without requiring a large mortise to be made therein.

FOUNTAIN-PEN.—F. E. SHAW, Evart, Mich. The piston being in inward position, the pen end of reservoir is immersed in ink and piston is drawn outwardly by the finger-piece of its rod, a protection contacting with inner side to move it. This sucks the ink into the reservoir. The rod is turned until its projection strikes the portion of contact member adjacent to the opening and is then thrust inwardly until its enlargement fills the opening. It is now ready for use. The charge exhausted, piston is returned to active position by drawing out piston-rod until the inner extremity of projection is outside the head. Then the projection is turned into coaction with contact member at the side opposite the opening, when the piston will be held so as to be forced inwardly.

SECRET DOUBLE SAFETY-POCKET.—C. H. SCOTT, New York, N. Y. The objects of the invention are to provide means for holding valuables or articles of any kind, effectually concealing the receptacle thereof by so constructing it as to permit it to be comfortably worn beneath the clothing, and to construct an efficient holding means for securing it to the person or garments, especially so as to enable it to serve the additional function of supporting hose or other garments.

SENSITIVE PHOTOGRAPHIC-PRINTING PAPER.—E. C. MORGAN, Kew Foot Road, Richmond, Surrey, England. The improvement in this case pertains to sensitized photographic-printing papers, plates, and films, more especially of the "self-toning" class, the invention consisting, essentially, in the employment as vehicle for the light-sensitive salts in the emulsion with which the support (paper, glass, celluloid, etc.) is coated of agar-agar and arrowroot or other starch in substitution for gelatin or collodion. When paper is used as the support, it may be pure raw paper or paper with baryta-coated surface.

HORSE-FLY TRAP.—J. MCCONNELL, Blaine, Wash. In the present patent the invention has reference to fly-traps; and the object is to produce a device of this character which is intended especially to be used to catch horse-flies, deer-flies, and other insects which torment horses. The device may be attached to any suitable point, a very desirable place being on a trace opposite to the middle of the body of a horse.

NON-REFILLABLE BOTTLE.—J. E. MOSEMAN, Donaldsonville, La. The improvement belongs in that general class of bottles which are provided with attachments adapted to prevent refilling after discharge of original contents, and it is more particularly an improvement in that special class in which the attachment comprises a stopper permanently secured in a bottle-neck and provided with a passage having a valve that will permit discharge but prevent entrance of liquid.

INFUSION DEVICE.—MARY H. FRENCH, New York, N. Y. This invention relates to tea-making devices; and its object is to provide a new infusion device for making infusions of tea and like substances in a very simple and convenient manner and to a strength according to the desires of those for whom the infusion is intended, the device also serving for holding sugar and like substances used for sweetening beverages.

SHAVING-BRUSH HANDLE.—J. L. ERSKINE, New York, N. Y. The purpose in this improvement is to provide a construction of one-piece handle for shaving brushes in which all the advantages of a two-piece or multiple-piece handle are obtained and whereby at the same time the cost of manufacture is not materially increased over the ordinary one-piece handle.

DRAFTING INSTRUMENT.—A. A. ALLEN, Ortonville, Minn. In this case the object of the invention is to provide a new and improved drafting instrument more especially designed for the use of tinners, plumbers, and other mechanics in laying out the blanks for forming elbows, T's, and other articles of sheet-metal and like material.

Household Utilities.

HOLDER FOR BROOMS AND BRUSHES.—J. HUTCHINSON, Belleville, Ill. This article of manufacture comprises an improved broom-holder formed of a single piece of wire, one end of which is screw-threaded and projects laterally, and a U-shaped body portion composed of opposite jaws formed by loops of the wire, the latter extending across diagonally from one jaw or loop to the other.

Railways and Their Accessories.

AIR-BRAKE SYSTEM.—J. E. SHAW, Council Grove, Kan. The regulation by the engineer of the exhaust and the establishing of communication between the locomotive-cab and the train, in this invention, is secured without in any way impairing the efficiency of the brake systems as they are used at present. On the contrary, they are made more effective by the maintenance of control of the brakes under all conditions.

MEANS FOR PREVENTING RAILS OF RAILWAY-TRACKS FROM CREEPING.—J. R. LEIGHTY, Cumberland, Md. This device serves as a stop to prevent any creeping of the rail—that is to say, when the device is applied it then constitutes a stop by reason of its construction and arrangement irrespective or in advance of the canting of the nut on the bolt which occurs by actual creeping of the rail and only serves to increase the gripping action of the device. The thrust of the tie in case of creeping of the rail is on the end of the main plate proper and not on the wings thereof.

FRUIT, PRODUCE, AND REFRIGERATOR CAR.—E. M. PHILLIPS, Castile, N. Y. The car is adapted for ventilation and for heating or refrigeration, as may be required. The most loss is from frost affecting cars at the bottom and ends. By the manipulation of the shutters and doors the car can be made much warmer in winter and cooler in summer; also, when it is desired to ship fruits, vegetables, etc., in warm weather (in bulk), the cold air from the ice-box will circulate beneath the floor, making the refrigerator much more effective than in the ordinary refrigerator-car. For this purpose it is necessary to close the door at the lower edge of one of the partitions.

CATTLE-GUARD.—J. COSTELLO, Glasgow, and W. D. MILLER, Saco, Mont. The object of the invention is to provide details of construction for a guard which effectively obstructs the passage of live stock along or across the rails and bed of a railroad. Means permit an animal to lift its feet and escape from the guard, the insecure footing and pain inflicted while avoiding serious injury so alarming the beast that it will retreat from the guard rather than traverse it in any direction.

RAILROAD SAFETY-ROD.—B. SARGENT, Rock Island, Ill. The improvement is in that class of bridles, ties, or couplings employed for preventing rails from spreading and which may be utilized independently of the ordinary ties upon which the rails are laid and spiked. Most efficient means are provided for preventing rails from spreading whereby perfect safety is obtained, and sleepers or ordinary ties supporting the rails are relieved of strain and wear incident to the usual means of fastening the rails thereto.

Pertaining to Recreation.

DEVICE FOR ATTACHING FISHING-LINES TO FLOATS OR SINKERS.—A. R. ROBERTSON, Pass Christian, Miss. This invention has for its purpose the provision of an attaching device of simple construction, by means of which a line may be quickly attached to and securely held in contact with a float or sinker, but permitting the float to be adjusted as desired, and that may be readily detached without removing hooks from the line or line from the rod.

Pertaining to Vehicles.

RUNNING-GEAR.—S. S. BREESE, Southampton, and C. L. LAURANCE, Bayshore, N. Y. This running gear is especially applicable for automobiles, but capable of general use. The objects are to provide a gear which will be lighter and of greater strength than those now known and also which will be flexible in all directions, but will operate without vertically deflecting the body of the vehicle.

STEERING-GEAR.—H. M. LOFTON, Atlanta, Ga. This steering-gear is especially intended for use on automobiles. Means are employed by which the inventor is able to avoid any and all of the accidents which result from a sudden jar acting upon the handle of the steering-gear, as the steering-wheel locks positively with the rack-bar, so the latter cannot move to any extent in either direction except when positively operated in such direction by the manipulation of the steering-wheel. By turning the wheel in either direction the bar may be moved in one direction or the other as desired.

NOTE.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of the paper.

Business and Personal Wants.

READ THIS COLUMN CAREFULLY.—You will find inquiries for certain classes of articles numbered in consecutive order. If you manufacture these goods write us at once and we will send you the name and address of the party desiring the information. **In every case it is necessary to give the number of the inquiry.**

MUNN & CO.

Marine Iron Works. Chicago. Catalogue free.

Inquiry No. 6956.—For manufacturers of stereopticon views.

For hoisting engines. J. S. Mundy, Newark, N. J.

Inquiry No. 6957.—For manufacturers' works of an electric clock; also dials and pendulums.

"U. S." Metal Polish. Indianapolis. Samples free.

Inquiry No. 6958.—Wanted, address of parties handling thermit used for welding rails and cast iron or appliances for using same.

Perforated Metals, Harrington & King Perforating Co., Chicago.

Inquiry No. 6959.—For manufacturers of electro-thermopiles.

Handle & Spoke Mchy. Ober Mfg. Co., 10 Bell St., Chagrin Falls, O.

Inquiry No. 6960.—For manufacturers of paper tubes and tube boxes, cartons, etc.

Adding, multiplying and dividing machine, all in one. Felt & Tarrant Mfg. Co., Chicago.

Inquiry No. 6961.—For manufacturers of Geissler tubes.

Commercially pure nickel tube, manufactured by The Standard Welding Co., Cleveland, O.

Inquiry No. 6962.—For manufacturers of fountains, vases, urns, etc.

Sawmill machinery and outfits manufactured by the Lane Mfg. Co., Box 13, Montpelier, Vt.

Inquiry No. 6963.—For manufacturers of drop hammers run by compressed air.

I sell patents. To buy them on anything, or having one to sell, write Chas. A. Scott, 719 Mutual Life Building, Buffalo, N. Y.

Inquiry No. 6964.—For manufacturers of laundry supplies.

The celebrated "Hornsby-Akroyd" Patent Safety Oil Engine is built by the De La Vergne Machine Company, Foot of East 138th Street, New York.

Inquiry No. 6965.—For manufacturers of mica-cutting machines.

Gut strings for Lawn Tennis, Musical Instruments, and other purposes made by P. F. Turner, 46th Street and Packers Avenue, Chicago, Ill.

Inquiry No. 6966.—For manufacturers of lock umbrella stands, patented by A. M. Foote, February 7, 1860.

Sheet metal, any kind, cut, formed any shape. Die-making, wire forming, embossing, lettering, stamping, punching. Metal Stamping Co., Niagara Falls, N. Y.

Inquiry No. 6967.—For manufacturers of churn power which could be applied to the dash.

You can rent a well equipped private laboratory by day, week or month from Electrical Testing Laboratories. 548 East 80th Street, New York. Absolute privacy. Ask for terms and facilities.

Inquiry No. 6968.—For manufacturers of machinery for making round and square splint matches.

Manufacturers of patent articles, dies, metal stamping, screw machine work, hardware specialties, wood fiber machinery and tools. Quadriga Manufacturing Company, 18 South Canal Street, Chicago.

Inquiry No. 6969.—For manufacturers of floral oil, such as is used in making perfumery.

Space with power, heat, light and machinery, if desired, in a large New England manufacturing concern, having more room than is necessary for their business. Address Box No. 407, Providence, R. I.

Inquiry No. 6970.—For manufacturers of working models of locomotives and steamboats, such as are displayed in ferry stations.

WANTED.—The patents or sole agency for Britain and France, of new machines and articles used in the Brewing and Allied Trades. Highest references given and required. State best terms with full particulars to "Wideawake," care of Streets Agency, 30 Cornhill, London, England.

Inquiry No. 6971.—Wanted, address of some model-making works and electrical novelty dealers.

Electrical and Mechanical Devices Manufactured. Inventors and others wishing to have specialties manufactured or estimates made as to the probable cost of manufacture, will do well to correspond with the undersigned. Frank Ridlon Company, Manufacturers of Specialties, No 200 Summer St., Boston, Mass.

Inquiry No. 6972.—For manufacturers of metal specialties.

Splendid opening for a high-grade mechanical engineer, who has had a broad experience in managing machine shops, the manufacture of machinery, engines and metal specialties. Applicants must be in prime of life and now employed. Preference will be given to applicants who have had modern scientific training in mechanical schools of high standing. Unqualified references will be exacted. All communications received will be regarded as strictly confidential. Address Mechanical Engineer, Box 773, New York.

Inquiry No. 6973.—For manufacturers of foot-power, coil-winding machines.

MOUNTAIN AND LAKE RESORTS.

Is the name of a beautifully illustrated publication of one hundred and twenty-eight pages just issued by the LACKAWANNA RAILROAD. The book contains a list of more than four hundred hotels and boarding houses among the various mountain and lake resorts reached by that road in New York, New Jersey and Pennsylvania. It suggests where to go, how to go, what it will cost and what can be seen and done when you get there. In addition there is a delightful love story entitled "A Paper Proposal," illustrated by well-known artists.

The book will be sent on receipt of ten cents in stamps addressed to T. W. LEE, General Passenger Agent, New York City.

Inquiry No. 6974.—For manufacturers of small gears for models.

2d-hand machinery. Walsh's Sons & Co., Newark, N.J.

Inquiry No. 6975.—For manufacturers of small gray iron castings ⅛ to 3-16 of an inch in thickness and about three inches long.

Inquiry No. 6976.—For manufacturers of creosote.

Inquiry No. 6977.—For manufacturers of soap machinery.

Inquiry No. 6978.—For manufacturers of an apparatus burning petroleum or kerosene that can be used in residences for heating hot water boilers.

Inquiry No. 6979.—For manufacturers of milk powder machinery.

Inquiry No. 6980.—For manufacturers of hand sewing machines to make Hessian flour and grain bags.

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

Buyers wishing to purchase any article not advertised in our columns will be furnished with addresses of houses manufacturing or carrying the same.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(9664) N. D. M. says: I require to build a cement flume and penstock in connection with my flour mill here to obtain power by water wheels to operate my mill. I have 11-foot head of water, my dam backs the water back about 25 miles, spring freshets are heavy. I want the flume and penstock all one piece of work, same width and depth from pond to tail race, except in penstock where wheels will be. Now what would be the proportion of cement and sand or fine gravel used and how thick would the walls and end be at bottom and top to stand pressure, or if all the same thickness all the way up? Flume and pit in all would be about 50 feet long and 9 feet wide. Flume part would be in a bank of earth while penstock would be exposed. A. In reply to your inquiry, we would say that a concrete for such a piece of work as you describe should be made of 1 part of a good brand of Portland cement, 3 parts of good, clean, sharp sand, and 5 parts of broken stone or clean, coarse gravel, free from dirt or sand. It is impossible for us to advise you regarding the thickness of the walls or their required width at the base, without detailed information regarding every part of the work. The work which you suggest is too important for it to be wise for you to go ahead with it without having plans prepared for you by an expert engineer or one who has had wide experience in such matters.

(9665) W. H. M. says: Will you kindly inform the writer how many pounds a balloon 8 feet in diameter, inflated with approximately 258 cubic feet of the ordinary street gas, will be able to lift? A. One cubic foot of coal gas at 32 deg. F. weighs 0.0354 pound. One cubic foot of air at the same temperature weighs 0.0807 pound. One cubic foot of coal gas in a balloon will therefore be able to lift 0.0453 pound, and 258 cubic feet will be able to lift 11.7 pounds, provided the temperature of the gas and the air is 32 deg. F. If it is 70 deg. F., this amount will be reduced to 10.8 pounds.

(9666) J. T. R. asks: Will you please favor me with the recipe for making concrete for sidewalks, something that I can guarantee not to crack. A. In order to make a thoroughly first-class cement sidewalk, proceed as follows: First, put in about six inches of clean, dry cinders. On top of this put six inches of concrete, made up as follows: 1 part of Portland cement, 3 parts of clean, sharp sand, 5 parts of good broken stone. This concrete should be thoroughly rammed in place until the water appears at the surface at every point. After the concrete is set, cover it with a coating, about 1½ or 1¼ inches thick, made up of equal parts of best Portland cement and clean, sharp sand. The latter should be troweled to a smooth, even polished surface. The concrete, if required in small quantity, can be most easily mixed by hand, turning the mixture of cement, sand, and stone with shovels until they are evenly distributed through the mass. If very large quantities are needed, it is more economical to do this mixing by machinery. The cost of concrete will depend very much upon the locality in which the work is done and the quantity desired. It should not, under ordinary circumstances, exceed about $6 per cubic yard.

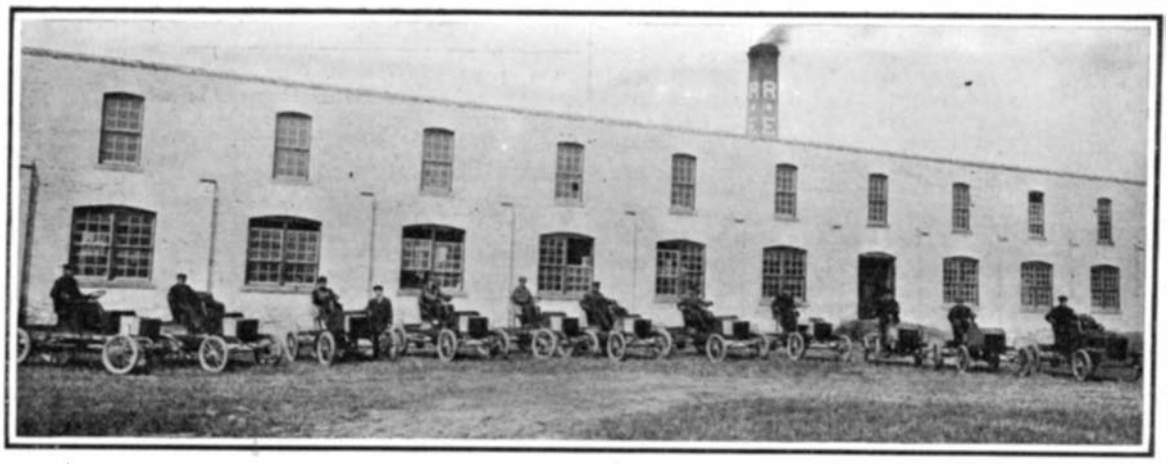
(9667) B. G. asks: 1. I have been asked why it is that cream came to the top of milk. Now, the specific gravity of cream is greater than milk, so why should it float? A. Your difficulty in understanding the rising of cream upon milk, and its separation in a separator, is due to your statement that the specific gravity of cream is greater than that of milk; this is not the case. Milk is heavier than water, its specific gravity ranging from **1.029 to 1.034 at 60 deg. F.** A quart of water weighs 2 pounds 1.38 ounces. A quart of milk weighs 2 pounds 2.38 ounces on the average; if it contains a larger per cent of butter fat it will weigh less, and if less butter fat it will weigh more. Since fat is lighter than water the more fat it contains the less the milk weighs, unless the lime and other solids which are heavier than water are also in greater proportion. So, also, milk is heavier after the fat has been removed. Skim milk has a specific gravity from 1.033 to 1.037. Cream, therefore, comes to the top of milk which is

THE PRODUCTION OF AUTOMOBILES ON A LAPGE SCALE.

HOW A MILLION DOLLAR AUTOMOBILE PLANT WAS DESIGNED AND SET IN OPERATION.

From the projecting of an automobile factory to the producing of 1,000 machines in nine months is a record that stands unparallelled in the automobile industry. Yet such is what has actually been accomplished under the management of that pioneer inventor in the field of the new locomotive—Mr. R. E. Olds. After having produced the first practical runabout for the man of average means, Mr. Olds was induced to turn his inventive ability to the production of a popular-priced, powerful touring car. The Reo Motor Car Company was organized August 27, 1904, for this purpose, and in less than thirty days an experimental factory was in full operation, producing the first Reo touring car. This machine made its debut on the road on the afternoon of October 14, during the course of which it displayed its fleetness and covered seventy miles. During the remainder of the fall this original Reo touring car covered over 2,000 miles.

So rapidly did the work of planning the large factory and surveying the ground for the same progress, that by September 15 this was accomplished, and ground was broken on the twenty-five acre site obtained by the company. This site is directly opposite the Grand Trunk passenger station, and it faces on the main street of Lansing. The Grand Trunk tracks bound it on the north, and the Lake Shore tracks on the east. Double side tracks are provided by both railroads, and, although the company's shipping facilities are of the best, at present a frequent sight is that shown in the middle left-hand cut, which depicts a train-load of Reo touring cars blocked on the siding. A very good idea of the general appearance of the factory, with its large testing track, can be had from the cut depicting the same, while the other views show the making of parts (such as flywheels, cylinders, etc.), the assembling of the chassis, and the finished chassis being tested before the boilers are mounted on them and the finishing touches given. Not only is all the machine work done in the new factory, but the bodies, also, are built, upholstered, and painted. Thus every part of the machine is made in the huge plant, which comprises altogether four two-story buildings, arranged as shown in the cut.



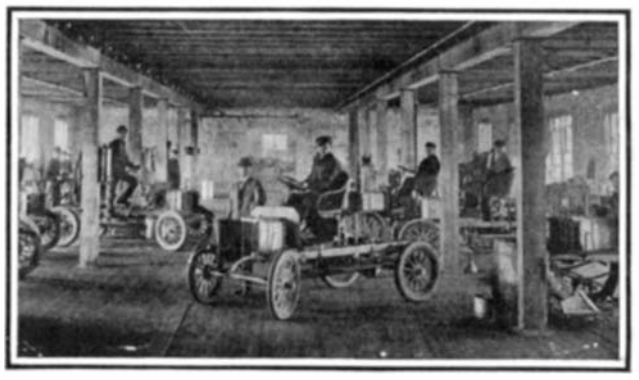
Outside Testers at the Reo Motor Car Works.

Mr. R. E. Olds.

Not only has the Reo Company turned out about 1,000 machines since the installation on December 15 last of the machinery in the first 75 x 800-foot building to be completed, but it recently startled the spectators at the Empire City Track Decoration Day races by defeating a 40-horse-power foreign racing car by one-fifth of a second with its "Reo Bird" racer, having two 16-horse-power stock engines coupled together and placed on a light chassis. The three miles were covered in 3 minutes 20 4-5 seconds, or at 53¾ miles an hour; and although this is remarkable time for a machine of but 32 horse-power and less than 1,432 pounds weight, any stock Reo touring car can be depended upon to travel 40 miles an hour, or over, at the will of the driver. Besides the touring car at $1,250, the company also builds a single-cylinder runabout at the price originally set by Mr. Olds—$650. Both of these machines are constructed with great care, of the best materials obtainable, and the possessor of either of them will find he has an automobile of comparatively small first cost, greatly reduced cost of maintenance, and a large percentage of dependability, which is the most desirable feature of any self-propelling vehicle.

While the work accomplished by the Reo Motor Car Company is remarkable, it is no more than might be expected when we consider Mr. Olds' past records and experience in gas engine and automobile manufacturing. The Reo Company will soon put out a commercial car that will be so low in first cost that the horse cannot compete with it.

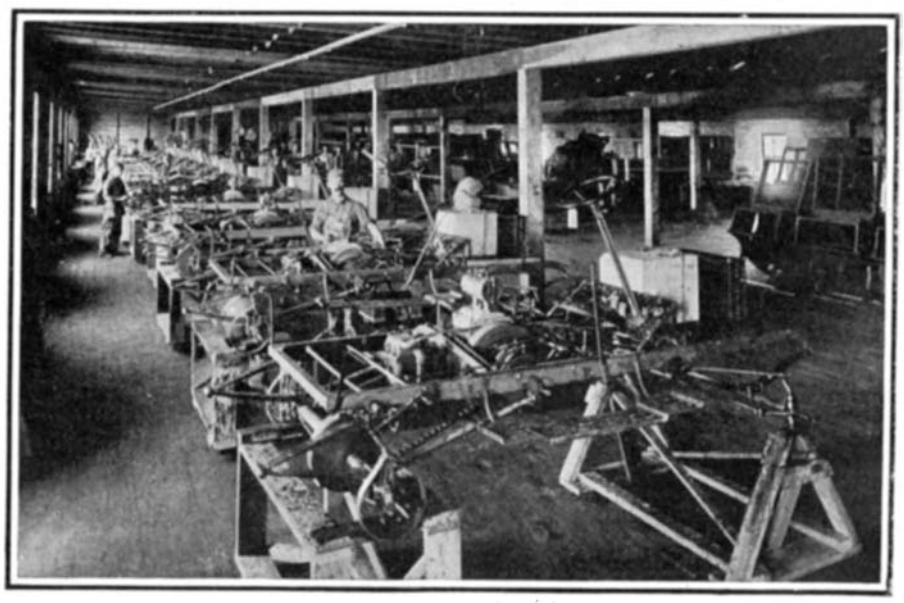
"Blocked on the Siding." Two Days' Shipments at the Reo Works.



The Road Testing Department.

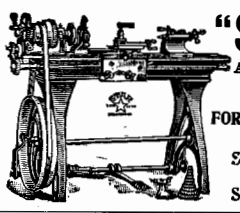
A General View of the Reo Automobile Works.

Main Machine Shop at Reo Works, Where 5,500 Parts Are Made Daily.



Reo Chassis in the Paint Shop. Hundreds of Reos May Here Be Seen.

WHERE THE REO AUTOMOBILE IS MADE.



"Star" Foot and Power Screw Cutting Automatic Cross Feed Lathes

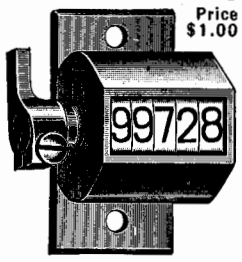
FOR FINE, ACCURATE WORK

Send for Catalogue B.

SENECA FALLS MFG. CO.
695 Water Street,
Seneca Falls, N. Y., U. S. A.

ENGINE & FOOT LATHES. MACHINE SHOP OUTFITS. TOOLS AND SUPPLIES. CATALOGUE FREE. SEBASTIAN LATHE CO. 120 CULVERT ST. CINCINNATI, O.

Veeder Counters



Price $1.00

to register reciprocating movements or revolutions. Cut full size.

Booklet Free

VEEDER MFG. CO.
Hartford, Conn.

Cyclometers, Odometers, Tachometers, Counters and Fine Castings.

SEE THAT YOUR TICKET READS VIA THE NICKEL PLATE ROAD

If you are going to Erie, Cleveland, Ft. Wayne, Chicago or beyond, and you will be assured a most satisfactory trip at the lowest possible cost. Through Pullman sleepers from New York and Boston to points above mentioned. Elegant high back seat day coaches. Famous Dining Car Service.

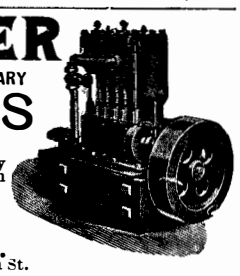
For rates to any point West or on the Pacific Coast, and before arranging for your trip, write R. E. Payne, General Agent 291 Main St., Buffalo, N. Y., or A. W. Ecclestone, D. P. A., 385 Broadway, New York City.

PALMER

MARINE and STATIONARY

MOTORS

2 and 4 CYCLE

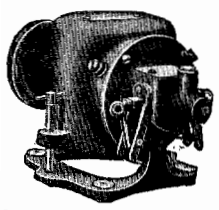


are no experiment, as they are in successful operation in all parts of the world.

Launches in stock.

Send for Catalogue.

PALMER BROS.,
Cos Cob, Conn.
New York Office, 34 W. 26th St.



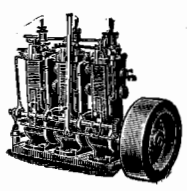
Igniter Dynamos

For all classes of

GAS ENGINES

for make and break or jump spark systems. Our latest type price $15. Write for circular of magnetos, etc.

THE CARLISLE & FINCH CO.
233 E. Clifton Ave.
Cincinnati, O.



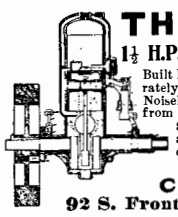
WOLVERINE

SELF STARTING AND REVERSING

Gasoline Marine Engines

3 to 18 horse power. Launches 18 to 75 ft. Write for catalogue.

WOLVERINE MOTOR WORKS
Grand Rapids, Mich., U. S. A.
Brooklyn office, 97 22d St.

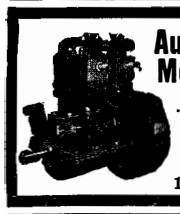


THE "LEADER"

1½ H.P. Gasoline Auto-Marine Engine

Built like a watch. Beautifully Finished. Accurately Constructed. Light, Strong, Reliable and Noiseless in operation. Suitable for launches from 15 to 19 feet in length. Price complete, $75.00 net, no discount. Thoroughly guaranteed. Perfect Speed Control. Complete descriptive catalogue upon application.

MANUFACTURED BY
CLAUDE SINTZ,
92 S. Front St., Grand Rapids, Mich.



Automobile and Marine Motors Simple, Compact and Powerful

Best Material. Perfect workmanship. Send for Catalog

ALEXANDER & CROUCH
40 So. Canal St., Chicago
1, 2 & 4 Cylinder, 4, 8 & 16 H. P.

Andrew Carnegie, Thomas A. Edison and many other successful men began their careers at Telegraph Operating. Why don't you learn? For $1.75 we will send you a complete N. D. outfit with book of instructions, by express (not prepaid). Send for catalog of electric apparatus, supplies and novelties.

J. H. BUNNELL & Co., Inc., 20 Park Place New York

How To Increase Your Business

READ carefully, every week, the **Business and Personal Wants** column in the

Scientific American

This week it will be found on page 507.

Some week you will be likely to find an inquiry for something that you manufacture or deal in. A prompt reply may bring an order.

Watch it Carefully

set away in quiet, because the cream is lighter than the rest of the milk. Butter also, after it is worked, floats in water or milk. Our figures are taken from a government report on the subject and may be received as reliable. 2. If a train weighing 400 tons is pulled by an engine that takes it at the rate of 35 miles an hour over a level track, what must be its power? A. On a level track, at a speed of 30 miles per hour, the train resistance varies from 13 to 17 pounds per ton. This multiplied by the number of feet traveled per minute, and divided by 33,000 will give the useful power exerted by the engine in horse-power.

NEW BOOKS, ETC.

PORT ARTHUR A MONSTER HEROISM. By Richard Barry. Illustrations from photographs taken on the field by the author. New York: Moffat Yard & Co., 1905. 12mo. 18 illustrations, 344 pages.

The author of this work is a young newspaper man who, at the opening of the war, set out for the scene of conflict with a small camera, small resources, and even smaller experience. But he possessed unbounded confidence and patience—qualities that held him at Tokio, when other correspondents were leaving in disgust at the delay—and finally landed him at no less a place than the Japanese lines before Port Arthur.

With such splendid opportunities for acquiring information, the author should have come home with ample material to write a clear, concise, and connected story of the siege. His photographs and facts, as given in this book, show that he has gathered the material; but unfortunately he has failed to arrange and relate his facts in the simple, straightforward style demanded by a subject so intricate and, to the outsider, so confusing, as this siege.

We could wish that Mr. Barry had followed throughout his book the direct and lucid style of the introduction, which is in such strong contrast to the heroics and "fine writing" of the book itself, as to make us suspect that some friendly pen has come to his relief. If the author had taken this introduction as the mesh, and woven into it the simple story of the facts as he saw and photographed them, he would have written a better, because a more understandable book.

At the same time, it must be admitted that the work is genuinely interesting; and as a series of thrilling, if disconnected, word-pictures by an eye-witness of the greatest siege of modern times, it will well repay perusal.

THE AUTOMOBILE POCKETBOOK. By E. W. Roberts, M. E. Cincinnati: The Gas Engine Publishing Company, 1905. 32mo.; pp. 329. Price, $1.50.

This small volume gives very concisely a great deal of information essential to the automobilist. It is intended as a pocket handbook and, therefore, has been made small in size—3½ x 5¼ inches—and bound in flexible leather covers. Besides describing all the main parts of a gasoline automobile, and telling how to make repairs when anything about it breaks down, Mr. Roberts gives hints on how to operate a car, and a chapter of "Don'ts," which tells what to avoid. There are many useful points regarding automobile designing which are discussed in the book. One chapter in particular that will be of interest is that telling how to make a brake test of a gasoline motor. The book is completed with an index. It is the best small volume on the automobile which we have seen thus far.

INDEX OF INVENTIONS

For which Letters Patent of the United States were Issued for the Week Ending June 13, 1905

AND EACH BEARING THAT DATE

[See note at end of list about copies of these patents.]

Adding machine, C. W. Horn	792,041
Advertising device, G. F. Bagby	791,997
Aeronautic apparatus, G. McMullen	792,154
Air brake angle cock holder and pipe clamp, railway car, R. R. Jones	792,137
Air mixer, T. M. Dudgeon	792,323
Alarm and controller for sprinkler tanks, etc., automatic, H. E. Reeve	792,237
Animal dipping tank, A. A. Kramer	792,139
Antimony, electrodepositing, A. G. Betts	792,307
Ash or garbage can, L. A. Harker	792,027
Automatic sprinkler, C. E. Buell....792,309,	792,310
Automatic sprinkler, R. W. Newton	792,343
Automobile dray, W. G. Thompson	792,561
Automobile folding top, W. N. Beecher	792,112
Baker's peel, R. L. Corby	792,400
Baling press, P. C. Southwick	792,359
Baling press, J. H. Pitkin	792,448
Basket or crate, Morley & McAtee	792,061
Battery. See Galvanic battery.	
Bearing and ladder support, upper tumbler, Knox & Ferris	792,522
Bearing for motor vehicles, wheel, A. Stechbarth	792,559
Bed rail locking device, A. R. Hampton	792,329
Bed spring bottom, B. Jungnickel	792,520
Bedstead clothes rack attachment, W. J. Dick	792,405
Bedstead construction, A. Taylor	792,366
Boiler, H. Molendo	792,535
Boiler cleaning compound, C. & E. H. Salazar	792,462
Boiler tube blower, G. E. Averill	791,996
Boiler tube cleaner, E. M. Adams, reissue	12,355

Over One Billion Dollars

Life Insurance in Force

Back of Every Home

should be its policy of Life Insurance in

THE PRUDENTIAL

which will guarantee a much needed protection to the family and the income.

The Prudential Policy is Found in Millions of Homes

Write for Particulars of Policies. Dept.

The Prudential Insurance Co. of America

INCORPORATED AS A STOCK COMPANY BY THE STATE OF NEW JERSEY.

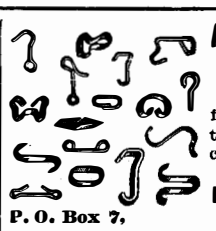
JOHN F. DRYDEN, President. Dept. 121 Home Office, NEWARK, N. J.

ECONOMY PITLESS WAGON AND STOCK SCALE

"ORIGINAL PITLESS"
15 YEARS ON THE MARKET
STEEL FRAME STEEL JOISTS
Equipped With Improved Folding Stock Rack

Scale Shipped complete, except planks for flooring. Complete Scale above ground; only 9 in. high. Gilt-edge guarantee. Thousands in daily use. Write for our catalogue and prices.

McDONALD BROS. PITLESS SCALE CO.
P. O. Box 322. PLEASANT HILL, MO.



Automatic Machines FOR FORMING WIRE

from coil into shapes similar to cuts. We can furnish machines or goods, as desired.

Send for Catalogue.

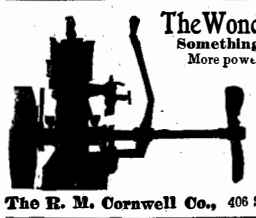
BLAKE & JOHNSON,
P. O. Box 7, WATERBURY, CONN.

Electrical Engineering

and Experimental Work of Every Description

We have every facility for producing first-class work promptly. Our factory is equipped with modern machinery throughout.

C. F. SPLITDORF
Engineering Dept. 17-27 Vandewater St., N. Y. City



The Wonder Gasoline Motors

Something New and Up-to-date

More power for less money than any other machine on the market. No valves, gears, etc., to get out of order. Jump Spark. Our 1½ H. P. marine outfit is a "WINNER." Solid or reversing propeller. Our prices will surprise you. Write to-day. Marine or stationary outfits to suit any requirements up to 5 H. P.

The R. M. Cornwell Co., 406 S. Salina St., SYRACUSE, N. Y.

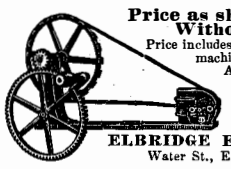
RUBBER STAMP MAKING.—THIS article describes a simple method of making rubber stamps with inexpensive apparatus. A thoroughly practical article written by an amateur who has had experience in rubber stamp making. One illustration. Contained in SUPPLEMENT 1110. Price 10 cents. For sale by Munn & Co. and all newsdealers.

THE MIDGET DYNAMO OR MOTOR

Price as shown $7.50
Without Hand Power $4.50

Price includes full instructions for the care of the machine and for performing 35 IMPORTANT EXPERIMENTS.

This machine has been on the market over ten years and has been gradually developed to its present state of perfection.



ELBRIDGE ELECTRICAL MFG. CO.
Water St., ELBRIDGE, N. Y., U. S. A.

The Frontier Four-Cycle, Jump Spark, Gas or Gasoline Motors

are built on scientific, reliable and economical principles. Every workman in the FRONTIER shop must demonstrate to the management some particular knowledge of gas engine construction. The result is a motor, the product of an aggregation of gas engine experts. Write for catalogue, marine or stationary.

THE FRONTIER GASOLINE MOTOR COMPANY
1378 Niagara Street, Buffalo, N. Y., U. S. A.

The Right Kind of a Motor

on land or water. Salisbury Double Cylinder Motor 4¼ x 5. Water Jacket Cylinders and Head, Aluminum Crank Case, Self-Oiling, Nickel Steel Valves, Forged Steel Shaft. Salisbury Motors are Reliable. Prices moderate.

Send for Catalogue.

BUFFALO ENGINE CO., Mfrs.
272-274 Michigan St., Buffalo, N. Y.

SUBSTITUTES FOR COAL

Are described from the technical standpoint in the following Scientific American Supplements.

Each Supplement named costs 10 cents by mail:

COMMERCIAL USES OF PEAT. SCIENTIFIC AMERICAN SUPPLEMENT 1324. The article enumerates the principal peat bogs and states their financial possibilities.

GERMAN BRIQUETTING MACHINERY IN AMERICA. SCIENTIFIC AMERICAN SUPPLEMENT 1411. A valuable economic report.

A NEW ELECTRICAL PROCESS FOR THE MANUFACTURE OF PEAT FUEL. SCIENTIFIC AMERICAN SUPPLEMENT 1492. The paper fully describes the Bessey process.

LIGNITE, PEAT, AND COAL DUST FUEL. SCIENTIFIC AMERICAN SUPPLEMENT 1426. A careful consideration of German methods.

MOOR CULTIVATION AND PEAT INDUSTRY IN GERMANY. SCIENTIFIC AMERICAN SUPPLEMENT 1481. An excellent critical review.

DOMESTIC COKE AND BRIQUETTES FROM RETORT COKE OVENS. By R. M. Atwater, SCIENTIFIC AMERICAN SUPPLEMENT 1211. A valuable monograph by an expert.

THE WHITE MINERAL PRESS FOR BRIQUETTING. SCIENTIFIC AMERICAN SUPPLEMENT 1224. An article describing and illustrating an American briquetting machine.

Price 10 cents each, by mail.

Order through your Newsdealer or from

MUNN & COMPANY
361 Broadway NEW YORK

Jaeger POROUS WOOLENS

Somebody said: Happy the man who doesn't know it's hot till he looks at the thermometer. In a Summer weight of Jaeger underwear you won't know it's hot till you see others sweltering in their linens and cottons.

Don't go on vacation without this safeguard of Health and Comfort

NEW YORK: 306 Fifth Ave., 157 Broadway. BROOKLYN: 504 Fulton St. BOSTON: 228 Boylston St. PHILADELPHIA: 1510 Chestnut St. CHICAGO: 82 State St.
Agents in all Principal Cities.

YOUR EYE RIGHT HERE!

Now let us send you the **Free Book** telling all about it. We will also send you Prof. Sloan's fifty original suggestions for improving your handwriting.

Conklin's SELF-FILLING PEN

"The Pen That Fills Itself"

Dip pen in any ink well or any ink, press lever and operation is over. As a matter of cleanliness, comfort and convenience don't you owe it to yourself to learn more about this perfect pen?

If you will let us send you our beautiful new illustrated catalogue, it will make you a CONKLIN enthusiast.

The Conklin Pen Co. 122 Madison Ave. Toledo, Ohio

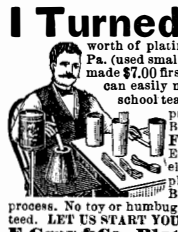
Represented in Great Britain by American Agencies, Ltd., 38 Shoe Lane, Farringdon St., London, E. C.: in Australia by Rae, Munn & Gilbert, 47 Market St., Melbourne.

50c. Buys this **Electric Light OUTFIT.**

3½ Volt Lamp, Receptacle, Switch, 10 feet of Wire and Battery, with Plain, Ruby, Green or Blue Lamp, all complete for **50c.**, and 15c. extra for postage, to any part of the world.

ELECTRIC NOVELTY CO., Providence, R. I., U. S. A.
Send for Catalogue.

I Turned Out $301.27



worth of plating in two weeks, writes M. L. Smith of Pa. (used small outfit). Rev. Geo. P. Crawford writes, made $7.00 first day. J. J. S. Mills, a farmer, writes, can easily make $5.00 day plating. Thos. Parker, school teacher 21 years, writes, "I made $9.90 profit one day, $9.35 another." Plating Business easily learned. **We Teach You Free—No Experience Required.** Everybody has tableware, watches, jewelry and metal goods to be plated. We plate with Gold, Silver, Nickel, Bronze, Brass, Tin, Copper. **Heavy Plate**—latest process. No toy or humbug. Outfits all sizes. Everything guaranteed. LET US START YOU. Write for Catlog, Agency and Offer.

F. Gray & Co., Plating Works, Cincinnati, O.

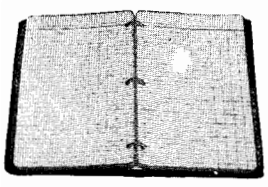
LE PAGE'S PHOTO PASTE IN JARS AND TUBES.

For photo or general use. Dries quickly—never discolors print. Very strong—corners will not curl. Largest bottle now sold for 5c. (by mail, 10c.) In bulk for large users, carton work, etc.

LE PAGE'S MUCILAGE 2 oz. size retails 5c.; by mail, 10c.

LE PAGE'S GLUE—1 oz., 10c.; by mail, 12c., bot. or tube. RUSSIA CEMENT CO., 139 Essex Avenue, Gloucester, Mass.

A LOOSE LEAF BOOK



For Vest Pocket, Coat Pocket and Desk

Used by Business Men, Professional Men, Salesmen, Engineers, Draughtsmen—in fact every man should use the "Unimatic" Book for memoranda, prices, costs and records of all kinds. Better than any card index. The **"Unimatic"** bound in full genuine black leather, flexible; is perfectly flat opening, and sheets may be instantly inserted or removed from any part. Twenty-eight sizes carried in stock. Five rulings, with or without index. Write for complete description, price list and sample sheets.

SIEBER & TRUSSELL MFG. COMPANY
4002 Laclede Ave., St. Louis

Book binder, loose leaf, J. P. Boehner	792,389
Book holder, J. A. Morrow	792,441
Boomerang gun, C. L. & E. M. Dawes	792,006
Bottle, S. M. Shields	792,355
Bottle, R. G. Julien, reissue	12,357
Bottle capping machine, H. Robinson	792,238
Bottle closures, manufacturing, W. Painter	792,284
Bottle, non-refillable, J. S. Root	792,170
Bottle, non-refillable, P. B. T. Berner	792,388
Bottle opener, W. G. Midgley	792,437
Bottle stopper, A. H. Schmedtje	792,352
Bottle washing or sterilizing apparatus, O. Eick	792,010
Box, H. Woerner	792,104
Brace rod, break jointed, J. P. Johnson	792,045
Brick or briquet machine, P. McKinnon	792,153
Brush and comb, combination, C. E. Flemming	792,013
Brush, bath, P. J. McCarthy	792,278
Brush knot making machine, M. G. Imbach	792,267
Building block and chimney, C. H. Nesselroad	792,342
Burial casket rough box, P. D. Skahen	792,082
Burner, A. Shiels	792,356
Butter cutting machine, N. Menard	792,339
Button, P. H. Murdock	792,063
Cage hanger, L. Braubach	792,492
Camera, multiple view, J. W. Anderson	792,245
Camera panoramic attachment, photographic, H. R. Kiessig	792,423
Can or receptacle, L. A. Harker	792,029
Car antifriction side bearing, railway, J. F. O'Connor	792,157
Car automatic passenger register, F. L. Kauffman	792,138
Car coupling, C. L. Dundey	792,507
Car door, J. M. Hopkins	792,040
Car door, freight, J. B. Smiley	792,173
Car door hanger, G. L. & E. D. Lucas	792,142
Car draft rigging, railway, J. F. O'Connor	792,156
Car draft rigging, railway, W. H. Miner	792,229
Car loader, F. D. Buffum	792,495
Car, motor operated dumping, C. P. Astrom	792,306
Car mover, J. E. Anderson	792,107
Car propelling mechanism, railway, S. L. G. Knox	792,272
Car, railway, H. S. Bayer	792,190
Car sill remover, J. Kheil	792,049
Car stanchion, railway, J. C. Mellor	792,532
Car step, C. C. Hummel	792,215
Car wheel, C. T. Schoen	792,465
Car wheel rolling machine, H. V. Loss	792,337
Car wheels, making, C. T. Schoen	792,464
Cars, system for transmitting electric currents to, J. J. Eagan	792,122
Cars, tandem spring draft rigging for railway, W. H. Miner	792,147
Carcasses, machine for treating the offal of animal, Hay & Daniel	792,262
Carriage top frame joint, W. J. Baker	792,387
Cart, J. V. Dunn	792,508
Cash register, T. Carroll	792,194
Cement bricks or the like, roller press for manufacturing, J. P. Jorgensen	792,222
Centrifugal machine, W. G. Howell	792,042
Chair. See Folding chair.	
Channeling machine, W. Prellwitz	792,287, 792,288
Checking system, restaurant, A. Nelson	792,280
Chilian mill, Pitkin & Stratton	792,161
Chimney cap, E. C. Dean	792,202
Churn feeding apparatus, F. M. Mulligan	792,537
Cigar holder, W. M. Randolph	792,236
Circuit breaker and closer for alternating currents, A. Gray	792,020
Circuit breaker, rotary mercury, A. F. Christmas	792,195, 792,196
Circuit controller, J. M. Barr	792,110
Clamp, Y. Yamamoto	792,376
Clasp, G. E. Figg	792,125
Clay washing machine, Herrick & Baldwin	792,031
Clevis, J. Lend	792,056
Clutch, friction, W. H. Brown	792,308
Coating, method of, L. A. Harker	792,028
Coils of rotating elements, binder for, B. A. Behrend	792,568
Collar, F. H. Norris	792,445
Computer, C. Campbell, Jr.	792,398
Computing machine, G. O. Gilbert	792,410
Concrete building block molding machine, L. V. Thayer	792,478
Concrete wall constructing mechanism, W. H. Pugh	792,289
Connecting device, A. B. Manchester	792,433
Containing can, P. S. Teller	792,242
Cooking and mixing machine, corn, W. L. Landon	792,140
Copper, hardening and tempering, C. R. Plumer	792,070
Corn and cob crusher and grinder, A. M. Zimmerman	792,186
Corner post, A. J. Solomon	792,358
Cornice brake machine, W. M. Johnson	792,136
Cot making apparatus, H. L. Campbell	792,002
Cotton picker's sack and support therefor, I. J. Clark	792,197
Cradle, weighing and automatic, L. Perotti	792,447
Cream separator, centrifugal, F. H. Fleege	792,577
Crucibles, manufacture of, A. L. J. Queneau	792,452
Cultivator, L. E. Waterman	792,243
Cultivator attachment, A. J. Joyce	792,046
Curling iron holder, M. I. Robinson	792,168
Current motor, alternating, Winter & Eichberg	792,102
Current motor, alternating, L. Schuler	792,466
Current motor control, alternating, Winter & Eichberg	792,103
Current motors, operating alternating, L. Schuler	792,467
Current regulator, constant, F. Conrad	791,120
Current system, constant, M. O. Troy	792,091
Cushion spring, W. R. Smith	792,083
Cuspidor, G. W. Carr	792,498
Cuspidor holder, G. W. Haverstick	792,128
Cyanids, making, J. Grossmann	792,259 to 792,261
Decorticating machine, textile, G. R. de Montlord	792,059
Dental matrix retainer, W. W. Minch	792,438
Derrick, traveling, M. A. Bogie	792,115
Desk or the like, school, P. J. Muller	792,062
Dial, perpetual planetary hour, W. H. Lewis	792,336
Discharging rod, J. Morwitz	792,442
Display frame, H. L. Turner	792,092
Ditching machine, J. Potvin	792,450
Door fastening, R. C. Catron	792,003
Door lock, B. E. Westlin	792,244
Door stop, G. M. D. Heard	792,129
Drain apparatus, automatic, R. G. McAuley	792,538
Dredges, ladder and tumbler bearing for elevator, S. L. G. Knox	792,27[illegible]
Drill, C. H. Haeseler	792,023
Dye adapted to form lakes, azo, Julius & Fussenegger	792,421
Dye, azo, M. Herzberg	792,034
Dye, black azo, M. Herzberg	792,03[illegible]
Dye, blue-black azo, M. Herzberg	792,032
Economizer and smoke consumer, W. F. Goodnow	792,327
Electric circuit protecting means, J. Hamilton, Jr.	792,025
Electric cut out box, A. T. & J. H. Kliegl	792,425
Electric engine, reciprocating, B. O. Wagner, reissue	12,356
Electric furnace, E. Haagn	792,022
Electric furnace, Fitzgerald & Bennie	792,255
Electric machines, remote control of dynamo, Woodbridge & Taylor	792,105
Electric motor braking device, A. Hultqvist	792,043
Electric motor system, A. F. Christmas	792,571
Electrical harness, W. D. McGregor	792,066
Electrically propelled carrier, W. J. Sumner	792,178
Electricity condensing apparatus, J. Morwitz	792,443
Elevator. See Movable elevator.	
Elevator safety device, automatic, J. A. Gray	792,208
Energy, means for protection against reversal of, L. Wilson	792,101
Engine and tender coupling, locomotive, Lewis & Kunzer	792,057
Engine reversing gear, steam, Hocke & Loffler	792,038
Engine vaporizing device, explosive, R. E. Olds	792,158
Engraving machine, W. S. Eaton	792,252
Entomological mount, C. A. Davis	792,501
Evaporator, fruit, W. J. Patton	792,235
Excavator, C. & J. T. Kerr	792,331
Explosive composition, A. Frank	792,511, 792,512
Eyeglass case, F. A. Tibbals	792,182
Fastener, I. Jackson	792,135

Rushton Canoes Lengths 15, 16, 17, 18 Feet

INDIAN GIRL MODEL

My "Indian Girl" Rushton Canoe is ready for you—29 years in the business have placed me in a position to FILL ALL ORDERS WITHOUT DELAY. This model is light and speedy—yet strong and durable Price, packed, $32-$44. Built of seasoned cedar—canvas covered. Send to-day for catalogue of pleasure craft, all-ceder and canvas covered canoes, oars, paddles, sails and fittings.

J. H. RUSHTON, 819 Water Street, Canton, N.Y.

Will Hair Grow?

Ten Minutes' Test Will Tell

You can tell by a ten minutes' use of the Evans Vacuum Cap whether it is possible for you to cultivate a growth of hair and we will send you the Cap without expense on your part and let you determine this for yourself.

If the Vacuum makes your scalp red and gives it a healthy glow, you can rest assured that by a reasonable use of the Cap you can cultivate a natural growth of hair. If, however, the scalp remains white and lifeless after applying the Vacuum, such a case would be a hopeless one, regardless of all the infallible hair restorers advertised.

If the gradual loss of hair and the baldness which follows were caused by DISEASE—physicians would have long ago found a remedy. Tonics and lotions applied to the outside of the scalp do soften the hair—but that's all. By exercising the arms, we build up muscle—***not*** by outside application of medicine. The arms, the body and the lower limbs can be exercised at will—but the scalp requires mechanical aid. Exercise makes the blood circulate, lack of exercise makes it stagnant.

The Vacuum method is the kind of exercise that makes the blood circulate. It gently draws the pure and undiluted blood to the scalp and feeds the shrunken hair roots. This causes the hair to grow. It is the simple, common-sense principle of PHYSICAL CULTURE, applied to the scalp.

Our Guarantee (Backed by the Bank)

We will send you by prepaid express, an Evans Vacuum Cap, allowing you ample time to prove its virtue, and all we ask of you is to deposit the price of the appliance in the Jefferson Bank of St. Louis during the trial period, subject to ***your own order.*** If you do not cultivate a sufficient growth of hair to convince you that this method is effective, simply notify the bank and they will return your deposit.

A sixteen-page book, illustrated, will be sent you free.

EVANS VACUUM CAP COMPANY

625 Fullerton Building **St. Louis**

20th CENTURY SOAP, a purely vegetable oil soap, containing no lye, but cleaning by the penetrating nature of its oils. Good for engineers, electricians, chemists, etc., it thoroughly removes all stains, such as rust, grease and oil, either from the hands or clothing, without injuring in the slightest. Also unsurpassed as a **DRILLING SOAP. HAS NO EQUAL FOR AUTOMOBILES.** For cleaning floors and walls, especially hard wood, it is invaluable. Has no equal for automobiles. Does not injure the polish, but adds to the lustre. If your dealer does not keep it, send us his name and address and we will send you a can free.

HOFFHEIMER SOAP CO., 169 E. Jackson Boulevard, CHICAGO

Eastern Office, No 1 Madison Square, NEW YORK. Renshaw Bldg., PITTSBURG, PA.

BECAUSE **DURO** cells are protected from damage. Between the **DURO** jars and the copper case is placed an interlining of **DURO** sealing compound. This compound has the qualities of rubber. Saves the heart of the battery from knocks and abuse.

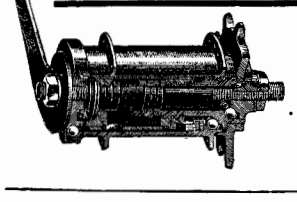
No. 7 The DURO BATTERY is BEST

DURO the Battery that wears.

CHICAGO BATTERY COMPANY, 1402 Michigan Ave., Chicago

EASY HILL-CLIMBING.

"The cyclist saves himself much sorrow If on his wheel he has the MORROW."



The steepest hill is as easily ascended as descended if the rider takes the precaution of having attached to his machine the very latest model of

THE MORROW BRAKE

which has every possible improvement tending toward safety, simplicity and efficiency. It ensures easy comfort to the rider under all road conditions. All parts are cut from solid steel and are interchangeable. Only one clutch—the Forward Drive. Symmetrical in design, perfect in every detail. No increased friction when pedaling. Price **$5.00.**

ECLIPSE MACHINE CO., Elmira, N. Y., U. S. A.

A BUSY LITTLE MOTOR

that is conscientiously made, and of the very best materials, that always does good work and lasts indefinitely is the

FRANKLIN DYNAMO

It has laminated field and armature and a capacity of 50 Watts. Will light six 6-candle lamps. Will run small lathe or a sewing machine. Price, complete, $13.50; or we supply full set of parts, with all materials and directions, for $8.50 up. We also sell sets of castings for half-horse power Gas-Engines, Blue Prints, etc., for $16.50. Catalogue "D" free.

Model Work a Specialty.

PARSELL & WEED,
MODEL AND EXPERIMENTAL SHOP,
129 West 31st Street, New York City, U. S. A.

Build Your Own Boat

By the Brooks System.

You can build your own Launch—Sailboat—Rowboat or Canoe—in your leisure time—evenings—and the work will be a source of profit and pleasure. It's easy when we show you how.

$12 covers the cost of a $50 boat. Cheaper boats cost less in proportion. Write us—we'll tell you how.

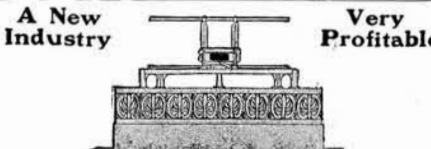
The Brooks System consists of exact size **Printed Patterns** of every piece, with **Detailed Instructions,** a complete set of **Working Illustrations,** showing each step of the work, an itemized bill of **Material** required and how to secure it.

Our system is so plain you cannot fail. A full sized pattern of each piece with instructions that not only TELL, but SHOW you, by illustrations, every detail.

Over six thousand amateurs successfully built boats by the Brooks System last year. Fifty per cent. of them have built their second boat. Many have established themselves in the boat manufacturing business.

Patterns of all kinds and sizes from 12 to 55 ft. Prices from $2.50 up—Catalogue and particulars FREE. For 25c, 100 page catalogue containing valuable information for the amateur yachtsman, showing several working illustrations of each boat, and a full set for one boat. Full line of knock-down and completed boats. When so ordered-Patterns are expressed, charges prepaid, C. O. D. to allow examination.

BROOKS BOAT MANUFACTURING CO.
Originators of the Pattern System of Boat Building
406 Ship Street, Bay City, Mich., U. S. A.



A New Industry — Very Profitable

Hercules Cement Stone Machine

Makes cement stone that looks like natural stone—many faces.

Makes any sized hollow cement blocks from 2 in. to 6 ft. long, also doors, sills, coping, ornamental designs, etc.

Tamps on the face of the mould allowing the use of a 2 to 1 mixture of sand and cement for facing, making the block impervious to moisture and true to pattern; a 5 to 1 mixture for backing. This saves cement and makes the strongest blocks.

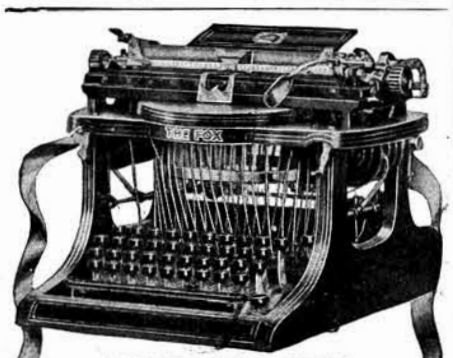
Hercules Blocks cheaper and more durable for building purposes than lumber, brick or stone.

Demand for Hercules Blocks strong and increasing every day.

Large profits for cement stone makers. Small capital required as one machine makes every shape of stone.

Send for Catalog Z and read about this new and profitable industry.

CENTURY CEMENT MACHINE CO.
189 W. Main Street ROCHESTER, N. Y.



DURABILITY
OF THE
Fox Typewriter

On account of its perfected and superior mechanical construction a Fox will outlast any other typewriter.

Repairs cost practically nothing, an important feature enjoyed by the Fox alone.

Write for particulars concerning our free trial plan, and also our 1905 catalogue just out.

Old machines taken in part payment, and easy terms given.

We want dealers for unoccupied territory. Write for our liberal proposition.

FOX TYPEWRITER CO.
Executive Office and Factory
826-840 Front St. Grand Rapids, Mich.

Feed apparatus, De La Rochefoucauld & Meland	792,275
Feed regulator, M. H. McCoy	792,540
Feeder, time stock, V. A. Croshier	792,200
Fence, A. G. Brust	792,393
Fence, J. M. Sutherland	792,476
Fence, wire, I. K. Hollinger	792,039
Fertilizer and making same, W. B. Chisolm.	792,314
Fertilizer or seed distributer for grain drills, J. F. McNeill	792,543
File, duplicate sales slip, P. W. Wirth	792,486
Filing and storing letters, etc., office etagere for, T. B. Knudsen	792,427
Finger ring, C. M. Levy	792,334
Fire escape, T. Toskey	792,088
Firearm hammer lock, M. V. B. Allen	792,382
Fireproof building construction, cellular steel, H. N. Wilson	792,302
Flexible joint, T. W. Moran	792,536
Flexible materials, apparatus for fixing, M. H. Rumpf	792,239
Flooring, W. H. Cooley	792,317
Flue stopper, J. Stuber	792,084
Folding box or crate, J. Amendt	792,383
Folding chair, B. C. I. Hallgren	792,127
Fork, C. W. Robison	792,350
Fountain comb, W. H. Evans	792,124
Fruit gatherer, E. A. Gallup	792,018
Fruit or vegetable cutter, F. R. Richards.	792,459
Furnace, G. S. Kent	792,048
Furnace bells, apparatus for changing blast, W. Kennedy	792,047
Furnace door, G. Dinkel	792,321
Furniture, wire, Watters & Larsen	792,370
Fuse, electric, N. Marshall	792,530
Fuse, shell, C. P. Watson	792,369
Galvanic battery, B. J. Blameuser	792,191
Game, card, G. S. Parker	792,345
Garment hook, H. Lockwood	792,526
Garment supporter, J. E. Royall	792,078
Garment supporter, L. C. Collins	792,499
Gas, generating combustible, C. Ellis	792,011
Gas meter, dry, H. Chrisman	792,118
Gas pressure regulator, Timm & Runge	792,479
Gas regulating apparatus, automatic, G. W. Wentworth	792,096
Gear, transmission, E. J. Swedlund	792,477
Gearing, transmission, E. C. Richard	792,167
Gin feeder, E. R. Barber	792,490
Glass blowing machine, C. F. Cox, et al.	792,500
Glass grinding or polishing apparatus, F. L. O. Wadsworth	792,564
Glass, making wire, F. & A. Shuman	792,172
Glass, manufacturing, C. Ellis	792,123
Gold dredging machine, S. L., L. J., & W. F. Crawford	792,250
Granular or pulverulent materials into lumps, converting, E. Pohl	792,449
Grate bar, W. McClave	792,539
Grinding or abrasive wheel, emery or other, F. M. King	792,050
Gun, O. Cook	792,316
Gun locking device, M. V. B. Allen	792,381
Gun register, Rairdom & Morgan	792,073
Gun sight, J. Kurig	792,274
Hair retaining comb, M. P. C. Hooper	792,266
Hair retaining comb, Nowacke & Loesser	792,282
Hand operated gate, J. O. Mitchell	792,534
Harness loop, H. W. Schlieper	792,171
Harness loop, J. Reichert	792,556
Harness support, R. L. Newell	792,444
Harrow, rolling blade or spade, G. Svanljung	792,294
Harvester, corn, A. V. Kiser	792,051
Hat stretcher, E. W. Sharbaugh	792,354
Hay rack, P. A. Myers	792,064, 792,065
Headlight adjuster, P. Peterson	792,550
Heat coil, self-soldering, F. B. Cook	792,315
Heater, J. Fink	792,325
Heating apparatus, steam, E. F. Osborne	792,283
Heating system, hot water, W. Bruckner	792,494
Hinge, Richter & Henkel	792,460
Hinge for screens, separable, J. F. Ware	792,094
Hinge, gate, J. F. Shelton	792,240
Hoisting apparatus, J. N. Wright	792,567
Hoisting device, M. Schiller	792,463
Holdback, J. Gauthier	792,513
Holdback device, A. P. Weeks	792,371
Hominy machine, N. H. & W. A. Miller	792,145
Hominy, making, N. H. & W. A. Miller	792,144
Horse detacher, A. H. Pence	792,347
Hose coupling, hydrant, G. Rathburn	792,074
Hose or pipe coupling, W. S. Houser	792,417
Humidifier or air moistening apparatus, S. W. Cramer	792,402
Husking peg, J. H. Akin	792,188
Hydrocarbon burner, J. F. Higgins	792,265
Identification system, C. F. Bush	792,312
Incubator, G. Hacker	792,416
Incubator egg tray, F. Borne	792,391
Induction coil, G. A. Campbell	792,248
Inhaler, hot air, N. K. Morris	792,230
Internal combustion engine, W. E. Clifton	792,119
Internal combustion engine, C. W. Weiss	792,300
Iron and steel therefrom, apparatus for treating ferruginous ore for the manufacture of, Moore & Heskett	792,440
Ironing machine, collar, W. J. Quinn	792,454
Irrigating implement, W. L. Banks	792,189
Knitting machine, F. B. Wildman	792,301
Lacing hooks, rivets, or the like, machine for setting, W. F. Fraser	792,017
Ladder, E. A. Meacham	792,436
Lamp chimney, A. P. Storrs	792,473
Lamp, electric arc, R. H. Read	792,076
Lamp holder, W. J. Phelps	792,552
Lamps, wall plug for incandescent electric, C. J. Malish	792,225
Lantern globe lifting device, D. C. Kline	792,270
Last, E. L. Goding	792,019
Last, boot or shoe hinged, H. W. Mobbs	792,277
Leather splitting machine, Quigley & Gay	762,164
Legs, support for the treatment of injured, W. Emge	792,407
Lens grinding tool, bifocal, J. P. Wimmer	792,303
Letter box, F. Clensey	792,004
Level, C. J. Dewaine	792,319
Level, plumb, Parrish & Reilly	792,160
Lightning arrester, C. T. Mason	792,435
Linotype machine, O. Southwell	792,472
Linotype machine, P. T. Dodge	792,504
Linotype machine, D. S. Kennedy	792,521
Linotype machine, D. Petri-Palmedo	792,551
Liquid cooling utensil, domestic, J. H. Doyle	792,506
Lock, O. Berry	792,491
Locomotive air draft, R. F. Cox	792,318
Loom picker, G. Falke	792,324
Lotion, Monteleone & Cesareo	792,148
Low water alarm, A. E. Gardner	792,257
Lubricator, F. O. Farwell	792,253
Mail box, J. W. Hunt	792,133
Mail chute, F. E. Anderson	791,995
Mail deposit box, F. H. Nichols	792,546
Mail pouch projector, J. D. Barber	792,108
Malt turning apparatus, Worz & Eisner	792,106
Match box, E. Antoni	792,385
Match box holder, W. G. Lewi	792,335
Match lighter, A. C. Loomis	792,430
Mattress, woven wire, O. G. Franks	792,256
Mattresses, means for securing the ends of wire, C. S. Lloyd	792,525
Measuring vessel, F. Albo	792,380
Meat or poultry holder, P. E. Floare	792,326
Metallurgical furnace, J. W. Lansing	792,223
Milking machine, Y. Stothard	792,362
Mine cage, J. Herzler, et al	792,330
Mixing apparatus, C. Sahm	792,461
Molding machine, C. H. Hutchings	792,044
Motor. See Current motor.	
Movable elevator, W. Norcott	792,232
Mower, lawn, A. Jackson	792,419
Mowing machine, D. Griffiths	792,021
Music and suspension rod, combined sheet, E. A. Hardy	792,210
Music leaf turner, W. L. O'Malley	792,159
Music rack and turner, combined, H. L. Abraham	792,304
Musical instrument, H. Rue	792,080
Nest, hen's, E. G. Denison	792,007
Nitrites, making, J. Grossmann	792,515
Nut lock, Mills & McKinnon	792,146
Nut lock, A. L. Stagner	792,360
Nut, lock, C. H. Smith	792,292
Oil and making same, W. N. Blakeman, Jr.	792,113
Oil cup, F. P. Maize	792,432
Oil cup, automatic, E. G. Moore	792,060
Oiler, A. A. Gray	792,412
Ordnance and howitzers mounted on gun carriers, supporting device for the sight adjusting mechanisms of, E. Ternstrom	792,180
Ordnance sight, R. P. Stout	792,175
Osteophone, electric, L. Potter	792,162
Oven, G. R. Moon	792,439
Oven, bake, A. F. Cherney	792,570
Oxygen inflating device, T. P. Pomeroy	792,348

If you want to eliminate all element of chance or uncertainty when you buy a typewriter, then buy a

Remington

The whole world Knows what a Remington will do.

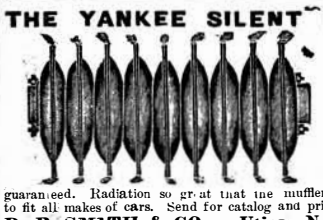
Remington Typewriter Company
New York and Everywhere

SAVE FIRE LOSS

The time to put out a fire is at the start—a few minutes' delay and it is beyond control, then what? Loss of property, loss of business, and perhaps loss of life.
Prevent this with
Badger's Fire Extinguisher,
it will put out any kind of a fire at the start
BADGER FIRE EXTINGUISHER CO.
80 Portland St., Boston, Mass.

THE YANKEE SILENT MUFFLER

(PAT'D)



Excels all mufflers because the discs expand according to the size of the explosion. A vacuum is created between the exhaust valves and the muffler, and back-pressure is overcome. 10 per cent. more power guaranteed. Radiation so great that the muffler keeps cool. Made to fit all makes of cars. Send for catalog and price.
D. B. SMITH & CO., Utica, N. Y., U. S. A.

BABBITT METALS.—SIX IMPORTANT formulas. SCIENTIFIC AMERICAN SUPPLEMENT 1123. Price 10 cents. For sale by Munn & Co. and all newsdealers. Send for catalogue.

Only **$8.00** for Imperial 8 Day Clock, worth $15. Face 3½ inch, porcelain. Burnished brass, waterproof case. Guaranteed 1

SAVE MONEY on AUTO SUPPLIES

We charge ordinary business advance on wholesale cost—**much less** than the usual "fancy" prices. Your money back if you want it, too.

The Whole Market before you in our catalogue. Send 10c. for it and order from your easy chair.

POST & LESTER CO.
44 Sargeant St., Hartford, Ct.
Largest Importers of Foreign Made Equipment.

Save Time and Money

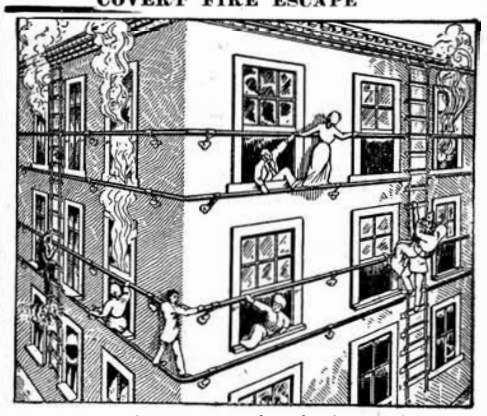
Progressive business men use
BATES
Hand Numbering Machine
It prints numbers consecutively, duplicates or repeats—changed instantly by turning pointer. To learn how it will save for you, send for Booklet 48 now.
BATES MFG. CO., 31 Union Sq., New York
CHICAGO—304 Wabash Avenue
Factory, Orange, N. J.

LUXURY IN TRAVEL
"THEY NEVER DISAPPOINT"
GRAHAM SUPPLEMENTARY SPIRAL SPRINGS FOR HARD RIDING AUTOMOBILES
CAN BE ATTACHED TO ANY CAR.
BOOKLET FREE. THE GRAHAM CO.
8 PARK PLACE, NEW YORK CITY, U.S.A.

SAFETY IN CASE OF FIRE

in all hotels, hospitals, asylums, theatres, churches, schools, factories and all public buildings, as well as private residences, is doubly assured when these structures are equipped with the

COVERT FIRE ESCAPE



Each room and window is provided with a safe and permanent means of egress, obviating the rushing through smoky or burning halls and corridors and consequent dangers to life and limb. Any number of people can escape easily and quickly by the new method. Best and most economical fire escape system ever devised. For circulars and full particulars, address
COVERT FIRE ESCAPE CO., - TROY, N. Y.

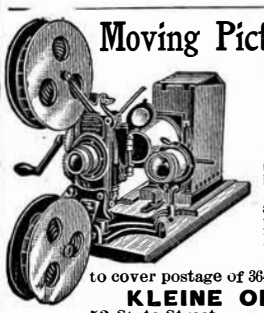
Road Freighting Traction Engines

Over 200 in use on Pacific Coast alone. Siberia, Spain, India, Central America, Sandwich Islands have them.

Engines 110 Horse-power. Wood, Coal, or Oil burning. Hauls 50 tons, takes grades 5 to 25 per cent. Capacity each car 16 tons.

THE BEST MFG. COMPANY
San Leandro, California
Cable Address. DANBEST. Codes, Western Union and McNiel.
Write for our New Catalogue No. 18.

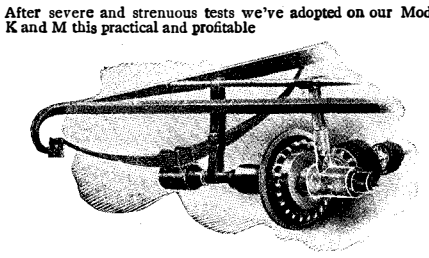
Moving Picture Machines



Films, Stereopticons, Views.
If you contemplate going into the public entertainment business, write for catalogue No. 9, which gives information and prices of Moving Picture Machines. Films, Stereopticons and Views. We offer dependable apparatus and views only; no second-hand goods for sale. Send 10 cents in stamps to cover postage of 364 page catalogue.
KLEINE OPTICAL CO.
52 State Street, - - - Chicago, Ill.

Gear Difficulties

After severe and strenuous tests we've adopted on our Models K and M this practical and profitable



ROLLER GEAR

the Gear that solves the problem of gear difficulties.

First of all, the teeth being cut deep and broad, almost entirely lessens the chance of breaking, while the case-hardened steel rollers on the driving pinion at the end of the shaft slide into the sprocket without any lost motion or slippage.

The Roller and Sprocket being lubricated in a dust-proof bath of oil, run in absolute silence.

The Gear is so firmly braced to the frame by the stay-bar that it cannot get out of alignment.

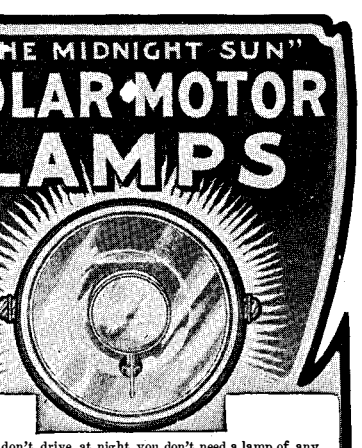
Investigate further by sending for our catalogue, call at our factory or agencies and learn just why the "HAYNES" with its dainty upholstery and trimmings is worth the price we ask, and why it is the car you should buy.

THE HAYNES-Apperson CO.
KOKOMO, INDIANA
Member A. L. A. M.
NEW YORK **CHICAGO**

Latest Style of **Merry-Go-Rounds**

EVANS & COMPANY
Manufacturers
Foot of Locks LOCKPORT, N. Y.

"THE MIDNIGHT SUN"
SOLAR MOTOR LAMPS



If you don't drive at night you don't need a lamp of any kind, but if you do, there is no more important part of your car than the lamp. Reliability and an intense light characterize the SOLAR, and are due to proper construction of lamps and correct principle of generator.

Experienced drivers demand SOLAR — why not furnish them? They cost but little more than "good enough" lamps and give absolute satisfaction. Illustrated catalog for the asking.

BADGER BRASS MFG. CO.
Kenosha, Wis.
New York Office, 11 Warren Street.

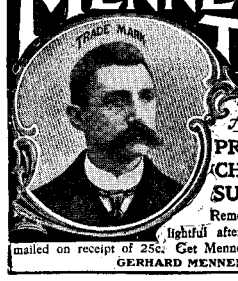
"ANATOMY OF THE AUTOMOBILE"

By DR. DYKE

Contains full descriptions, detailed mechanical drawings and full operating instructions for all standard American automobiles and several foreign cars. DIAGRAMS OF ELECTRICAL CONNECTIONS. Full descriptions and drawings of successful AIRSHIPS. Three books in one. Over 00 pages and 300 illustrations. Invaluable to the auto owner, agent, repairman and intending purchaser. **Price, postpaid, $2.50.** Synopsis sent on request. Get our catalogue of auto supplies.

A. L Dyke Auto Supply Co., Olive and Walton Sts., St. Louis
ROBT. F. BRITTON, Pres. and Mgr. ROY F. BRITTON, Sec. and Treas

MENNEN'S BORATED TALCUM TOILET POWDER



A Positive Relief For PRICKLY HEAT, CHAFING, and SUNBURN, and all afflictions of the skin.

"A LITTLE HIGHER IN PRICE, PERHAPS, THAN WORTHLESS SUBSTITUTES, BUT A REASON FOR IT."

Removes all odor of perspiration. Delightful after Shaving. Sold everywhere, or mailed on receipt of 25c. Get Mennen's (the original). *Sample Free.*
GERHARD MENNEN COMPANY, Newark, N.J.

SOUTHERN FARMS

In Virginia, North and South Carolina, Georgia, Alabama, Mississippi, Kentucky and Tennessee.

GOOD LANDS AT LOW PRICES

A healthy climate, long growing season, and an all-the-year working season.

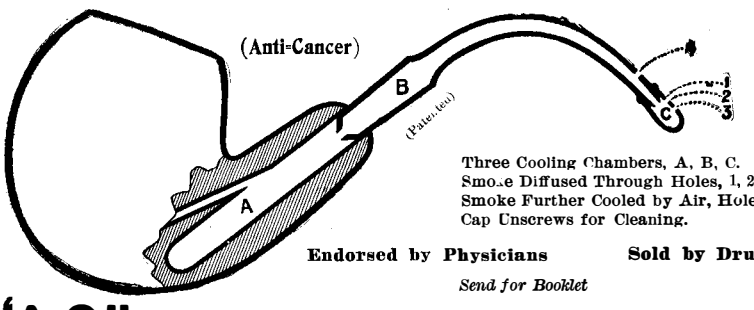
Good locations for Textile and Manufacturing Plants.

The South is now making greater progress than any other section. If you would learn about its developments and the opportunities for good locations along the Southern Railway, write for copies of our publications, including **The Southern Field**, a 16-page illustrated journal, sent free on request.

M. V. RICHARDS
Land and Industrial Agt., Southern Railway, Washington, D. C.

Packing ring, metallic, H. Gill	792,514
Packing, throttle valve, Graham & Sullivan	792,411
Packing vessel, W. J. Patton	792,346
Paint and making same, W. N. Blakeman, Jr.	792,114
Paper holder, C. Fisher 792,409,	792,575
Paper or other fabrics, mechanism for doubling or folding and cutting, R. C. Seymour 792,291,	792,557
Paring knife, H. Lockwood	792,527
Photographic shutter, Stocoum & Willsie	792,361
Piano, H. J. Weiler	792,095
Piano or organ player, automatic, A. F. Larson	792,054
Piano pedal action, E. Bornhoeft	792,192
Piano pedal action, J. Dierdorf	792,203
Piano player, automatic, A. F. Larson	792,055
Piano players or like instruments, winding and rewinding mechanism for, J. Courville	792,401
Piano string support, F. Denninger	792,503
Pianoforte or organ playing apparatus, J. A. Armstrong	792,386
Pipe coil, double, S. Thurstensen	792,295
Pipe coupling, H. Stuttle	792,085
Pipe coupling, J. Young	792,377
Pipe testing device, water, C. P. Brady	792,000
Pistol, E. S. Renwick	792,077
Placer machine, D. T. Barry	792,111
Planer, metal, W. J. Hagman	792,024
Planter, potato, H. J. Springer	792,293
Plastic block molding machine, J. M. McDowell	792,151
Pliers, W. C. Wolford	792,374
Plow, J. Triplett	792,184
Plow or cultivator stock, J. F. Bowers	792,392
Plumb and level, combined, C. J. Dewaine	792,320
Pneumatic drill, portable, R. A. Norling	792,281
Pole tip, vehicle, W. D. Miller	792,340
Post card, pictorial, A. Jasse	792,420
Post driver, W. H. Compton	792,249
Preserving vessel, fruit, V. Norman	792,233
Printer's block, J. L. Lee	792,332
Printing press, platen, A. Lagerman	792,523
Propulsion of screw steamers, A. Rateau	792,455
Prospector's drill, J. W. T. Olan	792,344
Protractor gage, R. Heddle	792,212
Pulley, expansible, L. J. Johnston	792,220
Pulley or sheave, awning, Smith & Fontaine	792,357
Pump, J. M. Shepard	792,081
Punching machine spacing table, Reynders & Sears	792,457
Puzzle, C. P. Ament	791,994
Pyrograph, W. H. Figg	792,206
Rail joint, E. P. Strauser	792,363
Railway block signaling system, electric, C. D. McPhee	792,279
Railway carriage automatic coupling, J. Willison	792,100
Railway cross tie and chair, E. Haupt	792,211
Railway crossing, W. S. Oliver	792,068
Railway crossing, A. A. Strom	792,365
Railway, electric, Chapman & Davies	792,569
Railway frog, A. A. Strom	792,364
Railway, pleasure, J. Kelly	792,422
Railway rail joint, O. S. Pulliam	792,163
Railway road bed construction, A. H. Jackson	792,268
Railway switch operating device, electric, C. W. Squires	792,174
Railway tie, C. W. Israel	792,134
Railway tie, composite, A. H. Jackson	792,269
Railway tie cutting machine, Hege & Traxler	792,263
Railway transfer apparatus, H. H. Porter, Jr.	792,071
Railway vehicles or trains, controlling apparatus for, A. M. Mattice	792,531
Razor, W. R. Christie	792,399
Razor stropper, J. A. Butler	792,117
Reclining chair, G. Francis	792,207
Reflector, prism glass shade, O. A. Mygatt, reissue	12,358
Register. See Cash register.	
Rein holder, O. B. Read	792,165
Respirator, fireman's, W. F. Merryman	792,227
Rheostats and electric heaters, resistance for, H. P. Ball	791,998
Rice hulling machine, S. C. Buck	792,395
Rivet remover, M. C. Straughn	792,474
Riveter, pneumatic spoke, C. Borg	792,390
Roasting furnace, F. Klepetko	792,053
Rock drill lifting mechanism, J. Jenkins	792,217
Rod stretcher, D. E. Norris	792,155
Rolling tubular bodies or blanks in a heated state, J. H. Nicholson	792,231
Rope socket, T. Canfield	792,497
Rotary engine, O. Jacoby	792,216
Rotary engine, J. T. Pagan	792,234
Rotary engine, E. Grubert	792,413
Rotary furnace, W. S. Rockwell	792,169
Rotary motor, C. A. Royse	792,079
Safe, F. H. Harris	792,030
Safe or vault bolt dogging means, Price & Gaston	792,072
Safes or the like, system for unlocking, W. W. Dean	792,404
Salt or pepper shaker, L. G. Lease	792,428
Sand band, N. E. Barnes	792,109
Sander, Simmons & Moore	792,470
Sanitary sweeping compound, J. Newman	792,544
Sash holder, J. Weldon	792,185
Sash lock, J. F. McKusick	792,067
Sashes, glass framing attachment for window, C. Yager	792,375
Scaffold, hanging, W. H. Morrow	792,341
Scale, recording, H. Cummer	792,201
Scissors, fruit, G. Towers	792,089
Scissors or shears, Melander & Jacquot	792,226
Scythe blade fastener, G. M. Fenn	792,509
Seal, R. C. Hoyer	792,214
Seal, bottle, E. J. Brooks	792,493
Seal, cording, E. J. Brooks	792,193
Sealing cap or closure, bottle, W. Painter	792,285
Seaming machine, can, F. W. C. Volkening	792,298
Separator, S. M. & W. L. Hanlon	792,516
Separator liner, centrifugal liquid, W. W. Marsh 792,434,	792,529
Sewing implement holder, C. E. Turner	792,297
Sewing machine, leather, R. N. Flanagan	792,576
Sewing machine needle motion, D. Noble	792,547
Shade and curtain fixture, J. M. Oliver	792,548
Shade and curtain supporting bracket, W. P. Gurr	792,328
Sheet metal forming machine, C. Hoff	792,132
Shirt neckband, J. D. MacBean	792,431
Shock or grain loader, W. B. Penrose	792,549
Shoe polishing stand, W. A. Morton	792,150
Shoes, machine for automatically ironing, Ballard & Copeland	791,999
Shredding machine cage, M. F. Williams	792,485
Sign, C. H. Loomis	792,058
Silk, making artificial, H. S. Mork, et al	792,149
Silk, treating, F. Jochen	792,218
Skein holder, H. L. Turner	792,563
Skirt and waist holder, C. F. Porter	792,553
Sled, C. A. Walter	792,368
Sleigh knee, J. C. Altschwager	791,993
Slotting machine, J. F. Hoy	792,418
Spark arrester, J. C. Gregory	792,209
Spectacle protector, C. E. Linnig	792,524
Speed limiting device, H. F. T. Erben	792,012
Spinning apparatus, A. E. Rhoades	792,166
Spinning ring, A. A. Lovejoy	792,141
Spinning spindle, A. A. Lovejoy	792,338
Square, bevel, O. M. Seibert	792,469
Stave sawing, matching, and jointing machine, J. A. Knight	792,271
Steamer hopper bunker, H. Burrell	792,311
Steering device for power boats, J. J. Donovan	792,121
Steering wheel spindle, T. J. Lindsay	792,276
Stereotype plate casting mechanism, J. L. Firm	792,574
Still, ammonia, H. A. Abendroth	792,379
Stirrup, T. A. Mills	792,228
Stone cutter's hand shield, W. D. Sullivan	792,475
Stone molding machine, building, J. P. Jorgensen	792,221
Stopper. See Bottle stopper.	
Stove, gas or vapor, Dean & Kendall	792,502
Street cleaner, E. G. Nicewaner	792,545
Street indicator, C. H. Bailey	792,489
Sulfuric anhydrid, catalytic apparatus for making, Eschellmann & Harmuth	792,205
Supporting device, detachable, G. C. Johnson	792,219
Sweat band, M. Miller	792,533
Sweeper, C. B. Ryan	792,351
Switch mechanism, F. C. Anderson	792,384
Switch throwing mechanism, M. F. Burkhart	792,397
Synchronizing device, J. D. Hilliard, Jr	792,035
Syringe, S. M. Weaver	792,299
Telegraph apparatus, P. E. Heina	792,264

Science Eliminates the Possibility of a Burnt Tongue



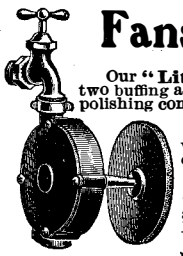
$1,000 Guarantee with each Pipe

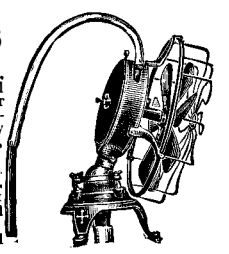
Three Cooling Chambers, A, B, C.
Smoke Diffused Through Holes, 1, 2, 3.
Smoke Further Cooled by Air, Hole 4.
Cap Unscrews for Cleaning.

Endorsed by Physicians **Sold by Druggists**
Send for Booklet

THE "A-C" PIPE, Principal Office 807 TIMES BLDG., TIMES SQ., NEW YORK

Fans WATER Motors





Our **"Little Wonder"** water motor and outfit, including emery wheel, two buffing and polishing wheels, pulley wheel, and sticks of silver and steel polishing compositions, is the only satisfactory outfit on the market to-day, for sharpening edged tools, grinding and polishing metals and silverware, running light machinery, etc. Attaches directly to any water faucet. About ⅛ H. P. according to pressure. **Price, complete, $4.00.**

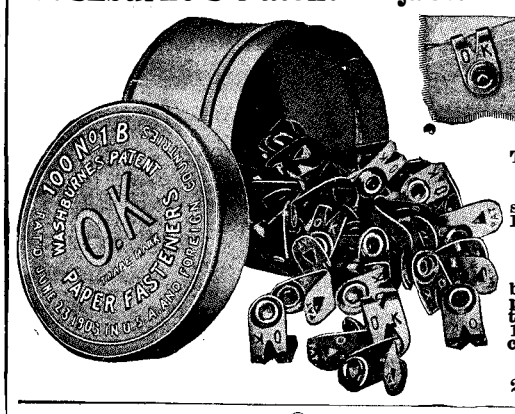
Our **"Hydrogiant"** directly attaches to any water faucet. It is a small handsome water motor, **ball-bearing throughout**, very speedy and serviceable at low water pressure. Equipped for any attachment. Especially useful to Dentists, Jewelers and Doctors. **Price, with pulley wheel, $5.00.**

Our **"Polar" bracket water fan** is a handsome 6 bladed polished brass fan with 7-inch enameled water motor, polished brass ball and socket joint, and brass guard. Elegant and efficient in every detail. Over 1,600 revolutions at 45 pounds water pressure. **Price of motor with fan and guard, complete, $18.00.** Our **"Arctic" 7-inch stand water motor** with 1½ or 3 inch brass pulley will run any kind of light machinery or apparatus requiring not more than ¼ horse-power. **Price, with pulley, $8.50.**

Larger water motors and fans of all sizes quoted upon request. Write us, for we have just what you want. Our goods are reasonable and absolutely satisfactory.

WARNER MOTOR COMPANY, Dept. 15, Flat Iron Bldg., NEW YORK CITY

Washburne's Patent Adjustable "O.K." Paper Fasteners



The neatest and most efficient of the whole "Paper Fastener Tribe."

Attached with the thumb and finger. Absolutely sure. Can be used over again. No points to catch. Lies flat. Will not rust. Made of brass.

Handsome in appearance, and they always work.

Put up in brass boxes of 100 Fasteners each. Ten **boxes to a** carton. Price **20 cents a box; $1.50 per 1,000,** at all stationers or from the Manufacturer, postage or express prepaid. **Sample box 10 cents** Illustrated booklet free. Liberal discount to the trade.

JAMES V. WASHBURNE, Mfr.
210 East Genesee St., Syracuse, N. Y.

The Only System

That **MOISTENS DRIES COOLS WARMS** **AIR**

Removes Dust and Ventilates.

Its versatility is proof of its correctness.

100 per cent. of our installations are successful.

Regenerated Cold Air Co.

88 Broad Street, BOSTON, MASS.

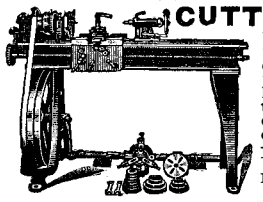
Medart Boat Building Materials

A system of supplying perfectly fitted boat parts, knocked down, enabling anyone handy with tools to build their own boat at one-half the boat factory's price. Freight low. Send stamp for catalog just issued.

FRED MEDART
8545 DeKalb Street St. Louis, Mo.

THE HARRINGTON & KING PERFORATING CO.
PERFORATED METALS OF EVERY DESCRIPTION FOR ALL USES.
SCREENS OF ALL KINDS.
225 NORTH UNION ST. CHICAGO ILL.

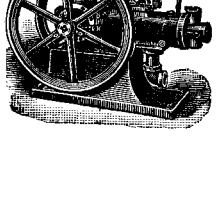
B. F. BARNES
ELEVEN-INCH SCREW CUTTING LATHE



For foot or power as wanted. Has power cross feed and compound rest. A strictly high grade, modern tool. Ask us for printed matter. Descriptive circulars upon request.

B. F. BARNES CO.
Rockford, Ill.
European Branch, 149 Queen Victoria St., London, E. C.

THE MIETZ & WEISS



Sizes from 1 to 60 H. P.
Send for Catalogue.

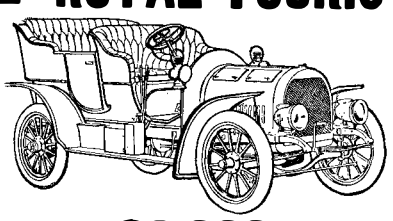
OIL ENGINES

Operated by Kerosene Oil, Fuel Oil, Distillate. Safest, Simplest, Most Economical and Most Reliable Power on the market.

Highest award for Direct Coupled Oil Engines and Generator, Paris Exposition, 1900. Gold Medals, Pan American Exposition, 1901, Charleston Exposition, 1902. Gold Medal and Special Diploma, Louisiana Purchase Exposition, St. Louis, Mo., 1904.

AUGUST MIETZ
128-138 Mott St., New York, U.S.A.
Catalogue Dept. **24.**

THE ROYAL TOURIST



$3,000

32-38 horse power, 2,500 pounds, 4 cylinders, vertical, shaft drive. More Exclusive Features of Merit than any other car in America. Guaranteed Deliveries. Write Dept. M for catalog.

ROYAL MOTOR CAR CO. - Cleveland, Ohio

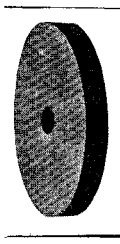
Run No Risks With An Auto!

Test your batteries every time before starting out, it may save towing expenses.
An accurate volt meter up to ten volts and ammeter up to 25 amperes.
Either one delivered prepaid on receipt of $3.50: the cheapest price on record.
All Automobile supplies at the same low figures.

THE MOTOR CAR EQUIPMENT CO., 43 Cortlandt Street, N. Y.

SENSITIVE LABORATORY BALANCE.

By N. Monroe Hopkins. This "built-up" laboratory balance will weigh up to one pound and will turn with a quarter of a postage stamp. The balance can be made by any amateur skilled in the use of tools, and it will work as well as a $125 balance. The article is accompanied by detailed working drawings showing various stages of the work. This article is contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **1184.** Price 10 cents For sale by MUNN & Co., 361 Broadway, New York City, or any bookseller or newsdealer.

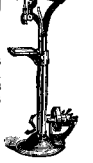


SPRINGFIELD ABRASIVE POLISHING WHEELS AND BLOCKS.

Used for polishing machinery, cutlery, and edge tools of all kinds and for removing rust spots from highly polished metal. Makes a very smooth surface without marring. Containing rubber which gives it the resilient effect. Made with either Emery or Carborundum in different grades. Write for price list and special trade discounts.

The Springfield Tire and Rubber Co.,
SPRINGFIELD, OHIO, U. S. A.

FRICTION DISK DRILL

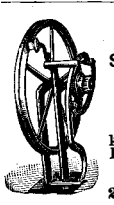


FOR LIGHT WORK.

Has These Great Advantages:

The speed can be instantly changed from 0 to 1600 without stopping or shifting belts. Power applied can be graduated to drive, with equal safety, the smallest or largest drills within its range—a wonderful economy in time and great saving in drill breakage. ☞ Send for Drill Catalogue.

W. F. & JNO. BARNES CO.,
Established 1872.
1999 Ruby Street, - - Rockford, Ill.



KICK

Single Kick or Double Kick. Kick With One Foot or Kick With Both—

BUT KICK

The **KICKDRIVE** is for driving all kinds of light machinery by foot power. Let us tell you all about it. Get the booklet

SLOTKIN & PRAGLIN
210-212 A Canal Street, New York

ILLUSTRATIONS.

A

Accumulators, ignition..... 70
Aeroplanes 260
Aeroplane, Archdeacon 366
Aeroplane, Alvares 480
Aeroplane contest 220
Aeroplane, Gillespie 497, 501
Aeroplane, Montgomery 404
Airship, Heaton's 186
Alcohol, sawdust 304
Amalgamator, new 148
Ambulance automobile 141
Amphitheater, Berkeley 326
Analysis, electro 163
Animals, inoculation of..... 221
Antennae, trees as.....117, 123
"Apache," yacht 417
Apple, seedless 101
Aquarium, New York..... 425
Arm rest, rifleman's..... 267
Army maneuvers, realistic.. 324
Automobile, ambulance 141
Automobile, American, new. 68
Automobile attachment 28
Automobile, five wheeled.... 386
Automobile, Grout 64
Automobile race, Florida... 105
Automobile races, timing .. 72
Automobile records, Florida. 127
Automobiles, foreign 60
Automobiles for 1905..... 56
Automobiles, mail 440
Auxetophone 382
Avalanches, Rocky Mountain 164
Aviation since 1891 260
Axes, polar 504

B

Ball, stone, moving..... 305
Banana culture 78
Barossa dam 257, 266
Barracks, fireproof 184
Barrels broken by ice..... 23
Batteries, storage, charging 341
Battleship "King Edward VII." 240
Battleship, section of..... 97
Battleship "Sevastopol" ... 207
Bayonet, renaissance of..... 421
Bee culture 387
Beehive incubator 488
Belt studholder 327
Bicycle, motor 65
Bicycle, two-speed 4
Bird, mechanical 220
Blackwell's Island bridge... 265
Blast, dynamite, a..... 161
Blue gum tree 44
Blue light as anaesthetic... 240
Boat, ice, motor..... 186
Boat, motor, race..... 446
Boiler, water tube 128
"Borodino," the 464
Boys, military, education, 184, 185
Braid winder 327
Brake, power 483
Bridge, Blackwell's Island. 265
Bridge, petrified 388
Brontosaur 37, 42
Bronze casting, rare..... 308
Burner, liquid fuel..... 303
Button working machine.... 465

C

Cable, 90,000 volt 260
Cable work, incident 447
Cadmium lamp 243
Camera, 65-foot 504
Can, oil, improved..... 128
Can, oil, new 108
Car, dumping 448
Car fender 168
"Caronia," Cunarder 204
Carpet stretcher 29
Cars, motor, views of..... 53
Cars, racing, American..... 424
Cars, touring, American....58, 59
Car, touring, National..... 67
Car, touring, Northern..... 64
Cat opens door 447
"Challenger," engine of.... 187
Chapel, concrete 101
Charts, hydrographic 343
Chicken-feeding machine 41
Chronograph, electro 107
Chronometer, graphic 441
Clock, astronomical 400
Clock, old, at Ulm 221
Coaling app. for steamers.. 460
Coal bin, turret 448
Cobra, the 420
Coelostat, a new 41
Coelostat, Dinwiddie 504
Column, horseshoe 305
Concrete foundations 400
Converter, Cooper Hewitt... 341
Cooler, milk 465
Coupe, electric 168
Coupling, hose 267
Crank-shaft, auto 61
Cream cooler 466
Creatures, queer 167
Croton dam 306, 307
Croton reservoir 297
Cruiser "Sentinel" 161
Cunarder "Caronia" 204
Cups, Pompeiian 346
Cylinder cock 28

D

Dairy, a modern 465
Dam, Barossa 257, 266
Dam, Croton 306, 307
Dead reckoner 441
Disk transmission, auto.... 340
Ditching machine 448
Door alarm 108
Door, balanced 360
Dredge, oyster 327
Dredger, harbor 24
Drydock at Boston.....335, 341
Dynamite blast, a 161

E

Eclipse expedition, U. S..503, 504
Egg transportation 106
Electric transportation 224
Electricity vs. steam..... 407
Electro-magnet, huge 163
Engine, kerosene 120
Engine of "Challenger" 187
Engine, producer-gas 180
Engines, motor boat 187
Exposition, Lewis & Clark, 364, 365

F

Falls, Victoria 344
Fender, car 168
Ferry, aerial, electric 461
Ferryboat, the largest..... 180
Firearm, magazine 368
Firearms, antique 247
Fire escape, improved 108
Fire extinguisher 408
Fire hose for car tracks.... 268
Fishes, deep-sea 188
Fishes, leaping, photog..... 348
Fleet, Russian, operations.. 207
Flying machine, Alvares.... 480
Fog dispersion, electric 121
Forest, petrified 388
Foundations, concrete 400
Freight subways, Chicago.... 205
Fuel, liquid burner 303

G

Gage, railway 268
Galvanometer, indicating ... 427
Garment hanger 28
Gas generator, Capitaine 180
Gas turbine, Stolze 74
Giantess, Finnish 305
Gobelin tapestry 385
Gold mining 177, 181
Grand Central Station..... 40
Grate, new 148
Gum moistener 268
Gun, an eroded 4
Gun, photographic 348
Gun-sight, Grubb 444
Guns, coast-defense 317, 320
Guns, dummy 324

H

Hammer, tack 148
Handle for kitchen utensil.. 28
Hanger, garment 28
Hanger, trouser 29
Harbor, New York 7
Harness, backing 228
Hay rack, improved 168
Hay stacker, new 100
Hippodrome, New York..237, 241
Hoarfrost, origin of 145
Horseshoe column 305
Horses, swimming school... 261
Hose coupling 267
House, dummy 324
Hydrolocomotive, a 20

I

Ice boat, motor 187
Ice, damage by 200
Ignition accumulators 70
Incense burners 346
Incubator, beehive 488
Indicator, tank 203
Inoculation of animals..... 221

J

Jerome Park reservoir 380
Jones, Paul 367

K

Kelvin, Lord 157
"King Edward VII." battleship 240

L

Laboratory, photo 484
Lace-bark 340
Lamp, cadmium 243
Lamp, photo, new 4
Lamp, trolley 268
Lantern, reflecting 487
Launch, weed-cutting 426
Lemur, ring-tailed 11
Lewis & Clark exposition, 364, 365
Life-belt, Gros 21
Life, creation of.....480, 481
Lifeboat "Uradd" 140
Lineman's support 267
Load maximum, of crowd... 320
Lobster, a large..... 10
Locomotive, a historic..... 420
Locomotive, distorted 308
Locomotive, express, modern 397
Locomotive, high speed, old. 467
Locomotive, water 20
Locomotive, steam vs. elect. 407
Loeb, Prof. J. 480
Logging, new method of.... 347
Loop, endless-train 217
Loris, slow, the 11

M

Macaroni 5
Magnet, electro, huge 163
Mail wagons, electric 440
Manhole packing 22
"Manxman," steamer 8
Map of Port Arthur..... 207
"Mercedes," motor boat.... 446
Mercury thermometer 160
Meridian, determination 23
Metal mixer, 750 ton..... 488
Meteorite, new 181
"Mikasa," the, in action.. 464
Milk pail, novel 468
Milk strainer 466
Milking machine 380
Mine, Russian, destroying.... 406
Mines, Japanese 206
Mines in Russo-Jap. war.... 477
Mining, gold 177, 181
Mollusk's growth 500
Motor, air-cooled, Curtis.... 70
Motor boat race..... 446
Motor, capillary 486
Motor, Christie 67, 68
Motor boat engines.....187
Motor ice boat 187
Motor, kerosene 120
Motor, touring car 57
Motors, air-cooled 56
Motors, foreign 61
Mukden, tombs at..... 244

N

Nervous suscept. measure .. 481
New York harbor 7
Niagara Power Co. plant... 104
Niagara Power plant..... 125

O

Oars, manning.....357, 360, 361
Oil can 108
Oil can, improved 128
Oils, flashing point..... 408
Oiler, new 108
Omnibus, motor, Brush..... 62
"Onontio," engine of..... 187
Oxygen at home 421
Oyster dredge 327

P

Packing, manhole 22
Pail, milk, novel 468
Panama canal 437, 445
Pantograph, reducing 202
Passenger station, concrete. 401
Pasteurizer, milk 466
Patrol wagon, police 62
Pavement of whales' bones. 76
Pen, fountain 267
Photograph puzzle 461
Pistols and rifles 247
Pitcher, sirup 327
Platform, subway 378
Plaques, Pompeiian 346
Port Arthur 227
Port Arthur, bombardment, 17, 25, 26
Port Arthur, map of..... 207
Prospecting, gold 177, 181
Prune cultivation 9

Q

"Quand-Meme," motor boat. 446

R

Race, yacht, ocean..... 417
Radiators, electric 141
Rail joint connection..... 267
Rail joint, new 228
Railroad, N. Y. Co., electric. 137
Railroad, old Portage..... 74
Railway gage 268
Railway, gravity 168
Railway, subaqueous 29
Railway tie and clamp..... 408
Reamer, blast hole 228
Refrigerator, electric 468
Reservoir, Croton 297
Reservoir, Jerome Park.380, 381
Revolver grip 28
Rheostat, effective 362
Rifle, coast defense.....317, 320
Rifles and pistols 247
Rim for detachable tires.... 261
Road testing machine 384
Roadway, rolling 200
Rotating bodies, balance.... 148

S

Salt making, California..... 264
School, swimming, for horses 261
Scouts, British 161
Scow, logging 347
Seam ripper 29
"Sentinel," cruiser 161
"Sevastopol," battleship ... 206
Shell digger 327
Shingle cutter 327
Side chair, bicycle 65
Silverware, Pompeiian 346
Simplon tunnel 225
Sirup pitcher 327
Sketch box 327
Ski in peace and war..... 124
Snow crystals 21
Snow statuary 241
Sounding apparatus 323
"Speedway," engine of..... 187
Stars, variable 485
Stage, auto, track..... 62
Station, Grand Central..... 40
Statuary, snow 241
Steam vs. electricity..... 407
Steamer, turbine, "Manxman" 8
Stereogram, parallax 76
Stone ball, moving 3 6
Strainer, milk 466
Street sprinkler, electric, 325, 326
Stud holder, belt 327
Submarines, new, British... 481
Subway, platform 378
Subways, Chicago 205
Sun spots 147
Swimming school for horses. 261
Switch, indicating 427

T

Tachometer, watch 160
Tack hammer 146
Tank indicator 203
Tapestry, Gobelin 385
Tupon, leaping 348
Tarsius, the 167
Tea slabs, Russian 308
Tent fastener 368
Thawing out pipes 140
Thermometer, high temp.... 427
Thermometer, mercury 160
Thermometer, registering ... 243
Thermostat, temperature ... 300
Tie, railway 408
Time, standard 300
Timing apparatus 72
Tire, new 448
Tire, non-skid 72
Tobacco pouch 128
Togo and his flagship..... 464
Tombs at Mukden 244
Train, armored, dummy..... 324
Training school, novel 144
Transformer for thawing pipes 140
Transmitter, wireless 263
Trees as antennae.....117, 123
Trolley lamp 268
Truck, electric 505
Truck, electric, diagram ... 506
Truck, gasoline 63
Tuna, leaping of 348
Tunnel, East Boston..... 45
Tunnel, Simplon 225
Turbine, gas, Stolze 74
Turbine steamer, "Manxman" 8
Turbine, water, largest..... 1
Typewriters, manufacture, 197, 201, 202

V

"Valhalla," yacht 417
Valise handle 128
Vases, Pompeiian 346
Vehicle attachment 108
Vesuvius of America 321
Viagraph 384
Victoria Falls 344
Virgin-lace 340
Viscosimeter, new 408

W

Wagon, delivery, Oldsmobile. 62
Wagon, patrol 62
Wagons, mail, electric..... 440
Wantibo, the 167
Warships, Russian, destroyed 457
Washington passenger station 401
Watch demagnetizer 368
Watch, remarkable 20
Watch, tachometric 160
Watch works, modern..... 300
Watches, antique 165
Water wheel, novel..... 20
Weed-cutting launch 426
Whale caught by cable..... 447
Wheel, spring, new 64
Wheel, water, novel 20
Whistle, automobile 483
Windmills, German 245, 246

Y

Yacht race, ocean.....417, 462
Yachts in cup race..... 405

MISCELLANY.

Figures preceded by a star (*) refer to illustrated articles.

A

Abyss, deep, exploration..... 487
Accumulators, ignition..... *70
Adams, Ernest K., death of. 103
Adrenalin from coal tar..... 419
Aeroplane, Archdeacon *366
Aeroplane contest *220
Aeroplane, Montgomery *404
Aeoroplane, Alvares *480
Aeroplane, Gillespie....*497, 501
Aeroplane, Montgomery 502
Aeroplanes *260
Airship, Baldwin 10
Airship, Heaton *186
Airship, Heaton, failure.... 159
Alarms, fire, novel 319
Alcohol, free, question of... 178
Alcohol from sawdust.....*304
Aluminium foil 361
Aluminium paper 367
Amalgamator, new *148
Ambulance automobile *141
Amphitheater at Berkeley...*324
Anaesthetic, new 299
Analysis, electro *163
Animal strength, tests of... 342
Animals, reasoning of 447
Animals, thinking of ....., 223
Antarctic expedition, Charcot 159
Antennae, trees as....*117, *123
Antwerp, port of 343
Apple, seedless *100, 143
Aquarium, New York *425
Archaelogical discovery, England 99
Arithmetic, first U. S..... 423
Arm rest for riflemen *267
Arts, mechanic, our heritage, 319, 339, 359
Assouan dam, the 358
Asphalt flooring at stations. 54
Astrolabe, portable 326
Astronomical instru. duty free 439
Astronomical news 106
Astronomy, anomalies in.... 262
Authenticity, Bureau of..... 322
Automobile, ambulance.....*141
Automobile, American, new. *68
Automobile attachment *28
Automobile, buckboard *65
Automobile cup race, Italian. 22
Automobile, five wheeled....*386
Automobile, foreign, exhibit. 38
Automobile for gardeners ... 443
Automobile and motor boat. 6
Automobile notes 10, 443
Automobile race, annual *105
Automobile race in Cuba.... 162
Automobile races, timing.... *72
Automobile records in Florida 98, *129
Automobile show, annual.... 54
Automobile, speed limit of.. 342
Automobile, steam, Grout... *65
Automobile steering device.. 483
Automobile street cleaner.. 443
Automobiles, disk transmission *340
Automobiles, electric, tests.. 10
Automobiles, foreign *60
Automobiles, leading *56
Automobiles, mail *440
Auto races in Europe 203
Auto stage, the Mack..... *62
Auxetopone, the *382
Avalanches, Rocky Mountain.*164
Aviation, progress of.....*260

B

Bacteria, inoculation with... 218
Ball, stone, moving..... 502
Ball, stone, moving.322, 403, 443
Ball, stone, motion of..... 423
Ball, stone, revolving.....*305
Ball, stone, that 363
Ballons sondes in U. S..... 419
Balloon, Santos-Dumont 168
Bananas *78
Barometer, grandfather's.... 179
Barossa dam *266
Barrel, life of 39
Barrels broken by ice exp... 423
Batteries, storage, charging.*341
Battle of Japan sea.....*457
*463, *464
Battleship "King Edward VII." *240
Battleship strength of world 418
Battleship "Sevastopol".....*206
Bayonet, renaissance *421
Bee culture *387
Bells, old Chinese 322
Belt, life-saving..... 408
Belt-stud tool *327
Berlin, population of..... 308
Bicycle, motor *65
Bicycle, two-speed *4
Birds, injuries to, curious... 99
Black-boy gum 423
Blackwell's Island bridge...*266
Blast holes, reamer for.....*228
Blast, photography of a....*161
Blue gum, Tasmanian *43
Blue light as anaesthetic...*240
Boat, ice, motor *186
Boat, motor, fastest..... 298
Boat, motor, race, France..*446
Boat, power, record..... 443
Boat, submarine, explosion.. 159
Boats, gas-propelled 67
Boats, motor, sea-going..... 70
Boats, submarines 348
Boiler packing 303
Boiler tubes, old, use..... 486
Boiler, water-tube *128
Boiler, water tube, Vanderbilt 338
Boilers, marine, early..... 488
Book, paper, oldest..... 459
Bone-treating process 346
"Borodino," the *464
Boys, military education of, 178, *184
Brake, power, auto.....*483
Brazil, additions to navy.... 220
Braid winder *327
Bread and electricity 439
Bridge, Blackwell's Island...*266
Bridge, Manhattan, scandal.. 358
Bridges, wind pressure..... 198
Bronze casting, rare *308
Bronze, tempering of..... 218
Brontosaur, the *42
Brontosaurus at Amer. Mus. 118
Brooklyn bridge problem.... 222
Buckboard automobile *65
Building blocks, concrete.... 202
Building, monumental 38
Bulkhead closer 29
Buoys, gas, explosion..... 362
Burner, liquid fuel 303

C

Cable work, incident *447
Cables, 90,000 volt.....*260
Cabs, electric, concourse.... 323
Cadmium lamp *243
Calendar, pocket, new..... 403
Calstenite 487
Camera, where set up.....*461
Camphor in Japan 263
Can, oil, improved....*108, *128
Canal, Panama 143, *442
Canal, Panama, plans for....438
Canal, Panama, sea-level.... 338
Cannons, hail, action 439
Canvases, preservation of.... 298
Canyon, Hudson River..... 27
Car, dumping *448
Car fender *168
Car, street, the first..... 345
Car, touring, National..... *66
Car, touring, Northern..... *64
Cars for Bennet cup race.... 362
Cars, pleasure, seaside..... 408
Cars, racing, American.....*424
Cars, steel, and safe travel. 178
Cars, touring, for 1905..... *58
Cars of U. S., census of.... 339
"Caronia," Cunarder *204
Carpet stretcher *29
Casualties, military 258
Cave dwelling, prehistoric... 167
Caves, ice, explanation..... 479
Cellulose from cornstalks... 505
Cement essays, prizes for... 119
Chair attachment, bicycle.... *65
Chapel, concrete, new.....*101
Charcot expedition safe..... 242
Charts, hydrographic *343
Chassepot, Alp., death of... 167
Chemical reactions 326
Chemistry of painting 298
Chicory, Belgian 503
Chimpanzee, characteristics.. 55
Chicken-feeding machine..... *41
China, Dresden, spurious.... 99
Chronograph, electro, Hopkins *107
Chronometer, graphic *441
Clamp, railway tie and.....*408
Cleaning fabrics 480
Clock, astronomical.....*400
Clock, astronomical, Ulm....*221
Clock, grandfather's 363
Clock, shadow 5
Clock, 2000-year 39
Coaches, vestibuled 183
Coal bin, turret *448
Coal, special, heating qual.. 200
Coal supply of future..... 418
Coal tests, free 488
Coaling steamers, app.....*460
Coast defenses, U. S..... 398
Cobra, the *420
Coecilians, new species of... 55
Coelostat, a new *41
Colon, tides at 238
Column of horseshoes *305
Comet, Borelly, new..... 23
Concrete building blocks.... 202
Concrete, reinforced, warehouse 366
Congo, salt marshes of..... 343
Congo telegraph 43
"Connecticut" contest 338
Converter, Cooper Hewitt....*341
Corona, solar, photography.. 459
Cotton, artificial 399
Cotton picking machine 148
Coupe. electric *168
Coupling, hose *267
Creatures, queer *11, *167
Crops, best paying 183

Croton dam, closing of..... 118
Croton reservoir, new.....*302
Crowding, load due to.....*320
Cruisers, turbine 118
Cruisers, scout, British.....*161
Cruisers, scout, U. S.....*120
Cups, Pompeiian *346
Current of 70,000 volts..... 422
Cuvier, attempt to frighten.. 259
Cylinder cock, new *28

D

Dairy methods, scientific....*465
Dam, Assouan, the..... 358
Dam, Barossa *266
Dam, Croton, closing of..... 118
Dead reckoner, electric.....*441
Defenses, coast, U. S..... 398
"Delfino," submarine 19
De Magnete, Gilbert's 308
Development, rapid 363
Diamond, the largest 123
Diamond, cutting 368
Disk transmission, auto.....*340
Dining, dangers of 199
Dinosaur Hall, Amer. Mus.. 118
Dissociation, theory of...183, 243
Ditching machine *448
Dogs, selection of 303
"Dominican," battleship, speed 4
Door alarm, automatic.....*108
Door, balanced *360
Door latch *268
Dover-Calais ferry 19
Drainage of London 187
Dredge, oyster 327
Dredger, steam *24
Drydock, new, Boston.....*341
Drydock, Sparrow's Point.... 342
Duxbury reef 303
Dynamite, blast, photography *161

E

Earth, cubic feet, weight... 463
Earthquake in India 359
Earthquakes 466
Easter, date of 303
Eclipse expedition 99
Eclipse expedition, U. S....*503
Education, Kelvin's *162
Egg transportation *106
Eggs of the knot..... 208
Electric power in Baltimore. 81
Electrical notes 82, 422
Electricity and bread 439
Electricity, new uses of..... 83
Electricity in plant growth. 458
Electricity vs. steam.....*407
Electricity, transportation by.*224
Electro-magnet, huge *163
Engine, driverless 406
Engine, kerosene *120
Engine, petrol, reversible... 466
Engine, producer-gas.....*180
Engines, combustion 67
Engines, motor boat.....*186
Engineering, civil, 1904 2
Engineering notes.....19, 80, 182, 363, 423, 499
Engineering, steam, 1904.... 3
Engineering, steam, facts... 186
Engineering, subaqueous ... 106
Erosion, gun *4
Explosive, safe, wanted..... 302
Explosives, modern 423
Explosives on trains 418
Expedition, polar, Duc d'Orleans 506
Expedition, the Charcot 159
Exports, our 98
Exposition, Lewis and Clark, *364, 462
Eye, photography of..... 143
Eye strain, how relieved.... 498

F

Fabrics, cleaning 480
Fabrics, textile, paper..... 358
Facts, conclusion from..... 299
Falls, Victoria, harnessing..*344
Farmers in wheat belt, need 103
Fayoum, discoveries in..... 399
Fender, car, new.....*168
Ferry, aerial *461
Ferry, railway, Dover-Calais. 19
Ferryboats, large *180
Fibers, electrification 208
Fire alarm, automatic..... 102
Fire alarms, novelties in.... 319
Fire escape, new.....*108
Fire extinguisher *408
Fire hose for car tracks.....*268
Firearms, ancient *246
Firearms, magazine *368
Firing attachment, new..... 126
Fishes, deep-sea *188
Fishes, leaping *348
Float, fire and salvage..... 6
Flying machine, Alvares....*480
Foaming in boilers, effect.... 99
Fog dispersion, electric.....*121
Food value of fruit..... 198
Forest fires over battlefields.. 308
Forest, petrified, a.....*388
Forest preservation..... 118
Forestry and railroads..... 7
Freight subways, Chicago....*205
Friction in machinery..... 460
Fruit, food value of..... 198
Fulford, E. D., death of.... 29
Furnace, electric, new, prod.. 199
Furnaces, electric 443
Furs, fraud in..... 163
Fuses, electric 427

G

Gage, railway *268
Galvanometer, Einthoven.... 82
Galvanometer, sensitive 423
Garment hanger *28
Gas buoys, explosion..... 362
Gas engine, Capitaine *180
Gas engines for factories.... 139
Gas exhauster, turbine 302
Giantess, a Finnish *305
Glass, changing color....143, 203
Glass, plate, machine..... 483
Glass pot, new 19
Glass, weathering of..... 183
Glove, a rubber film..... 439
Gold from sea water..... 146
Gold prospecting methods....*181
Good old times 247
Gouge, H. A., death of..... 23
Gramophone, a 319
Gramophone reinforcer.....*382
Grand Central station..... *40
Grate, new type of.....*148
Gratings, Rowland 247
Green sand 84
Gum moistener *268
Gum tree, Tasmanian..... *44
Gun erosion *4
Gun, photographic *348
Gun sight, Grubb *444
Gun, wire-wound, attack on. 438
Guns, coast defense *320

H

Hammer, tack *148
Handle for kitchen utensils.. *28
Harness, backing, for teams.*228
Hay rack, improved *169
Hay stacker, novel *100
Heavens in February 55
Heavens in March 179
Heavens in April 259
Heavens in May 339
Heavens in June 439
Heat from radiators 103
Herculaneum, excavation..23, 39
Hewitt inventions, some new. 119
Hill-climbing contest, a..... 443
Hippodrome, New York.....*241
History, repetition of..... 54
Hoar frost, origin of.....*145
Horological exposition 368
Horse swimming school.....*261
Horseshoes, column.....*305
Hose coupling *267
Household waste, burning... 242
Huckleberry growing 228
Hydraulic plants, Italian ... 426
Hydrolocomotive, a *20

I

Ice boat, motor *186
Ice caves, explanation of... 479
Ice, damage by *200
Ignition accumulators *70
Incense burners, antique *346
Incubator, beehive *488
India, geological survey of.. 459
Indian ocean, research exp... 399
Indicator, fire-damp 500
Indicator, tank, magnetic.... *203
Induction, magnetic, pressure 18
Injector, breakage of a..... 106
Inoculation of animals *221
Inoculation of crops 305
Inventions, oddities in...28, 128, 268, 327
Inventions, recently patented 12, 30, 47, 90, 108, 129, 149, 169, 189, 209, 229, 247, 269, 309, 327, 349, 369, 389, 409, 428, 449, 469, 489, 507
Inventor, misunderstood 447
Inventors, electric, prizes for. 27
Inventors, hint to 383
Inventors, prizes for 488
Iron ore of Fayal mine..... 61
Iron, pig, process 223
Iron used as money..... 482
Iron works, Japanese 138
Iron, wrought, direct process. 159
Irrigation in India 363

J

Japan, losses on the sea..... 238
Japan sea, battle of 458
Jerome Park reservoir.....*381
Jones, Paul *367
Jupiter, sixth satellite 39
Jupiter, seventh satellite.... 203

K

Kelvin, scientific education..*162
Kilauea, crater of 443
Kiln, cement, rotary..... 103
"King Edward VII.," battleship *240

L

Labor on Panama isthmus.. 487
Laboratory, photo *483
Lace bark of the tropics.....*340
Lake Erie, water supply.... 218
Lake Baikal railway 459
Lamp, cadmium *243
Lamp, incandescent 102, 440
Lamp, mercury vapor 29
Lamp, photo, new *4
Lamp, trolley *268
Lamp, Welsbach 342
Lantern slides, printing on.. 419
Lantern, reflecting *487
Latch, door *268
Launch, power, weed.....*426
Launches, motor, prize for.. 123
Law, trade-mark, new..... 19
Law, trade-mark, new..... 178
Laws, natural, overcoming... 259
Lemur, ring-tailed *11
Lewis and Clark Exposition, *364, 462
Life, creation of *480
Life-belt, Gros *21
Lifeboat, new type *140
Lily, black 103
Line and engineer corps..... 423
Lineman, support for *267
Liquid drops 239
Literature for the country... 419
Load, maximum, crowding... 318
Lobster, the largest *10
Locomotive boiler, Vanderbilt 338
Locomotive, distorted *308
Locomotive, driverless 406
Locomotive, high-speed *402
Locomotive, high speed, old..*467
Locomotive, historical *420
Locomotive, internal combustion 81
Locomotive, Purdue University 403
Locomotive, road, electric... 243
Locomotive tender, new..... 163
Locomotive, water-driven.... *20
Locomotive works, Baltimore 403
Locomotives, French and American 18
Locomotives, gas driven..... 98
Locomotives, steam and electric *407
Logging, new method.....*347
London, drainage of 187
London, suburban traffic..... 218
Longitude, discrepancy in... 179
"Loongana," turbine steamer. 182
Looping the loop *147
Loris, slow, the *11
"Louisiana" contest 338
Lubricator box, quick start.. 426
Luxor, tombs of, discoveries. 439

M

Macaroni, manufacture *5
Magnet, electro, huge *163
Magnetic indicator, tank....*203
Mail automobiles *440
Manganese, borate of 199
Manhattan bridge scandal... 358
Manhattan loop, proposed.... 198
Manhole packing 22
"Manxman," turbine steamer *8
Marconi in court 366
Merchant marine 3
Mercury thermometer *160
Meridian, determination of.. *23
Metal mixer, 750 ton.....*488
Metals made radio-active..... 259
Meteorite, new *181
Meteorites, constitution 319
Meteorological summary.383, 459
Meter, protest against 143
Methyl aldehyde in smoke... 459
"Mikasa," the 464
Military maneuvers, realistic *324
Milk analysis, new meth... 479
Milk pail *468
Milking machine, new *380
Mine, Russian, destroying...*406
Mine shaft, up-driven..... 182
Mines in Russo-Jap. war...*482
Mines, submarine 362
Mines of U. S. productive... 186
Miners, British, number of.. 439
Mining, gold, methods *181
Mistral, prize to 99
Mollusk, development *500
Moon, solidification of 319
Mond Gas Power Co..... 24
Mont Blanc railway, new.... 366
Mont Pele, crater of..... 379
Mont Pele, new dome..... 403
Motor bicycle *65
Motor boat engines *186
Motor boat race, French.....*446
Motor, capillary *486
Motor car, trial of..... 70
Motor cars, tractive effort.. 488
Motor, gasoline, marine..... 423
Motor, gasoline, powerful.... *70
Motor, kerosene *120
Motor omnibus, Brush *62
Motor, petrol, reversible..... 466
Motor sleigh, new *57, *84
Motor, touring car *57
Motors, air-cooled *56
Motors, gas, for factories.... 139
Motors, Long Island R. R... 22
Motors, some foreign *61
Multiplication, rule for 247
Mukden, tombs at *244
Muscular contraction 459
Music for public 29

N

Naval programme, British... 239
Navigation, aerial 3
Navigation on Lake Titicaca. 427
Navigation, steam, before 1836 203
Navy and army, 1904 3
Navy training school, U. S..*144
Nebulae, number of the..... 76
Nervous suscept. measure...*481
New York harbor *7
New York harbor entrance.. 103
New York water supply..... 218
Niagara Falls, power below. 363
Niagara Falls, vandalism.... 298
Niagara power plant..*104, *126
Niagara power, Goat Island. 299
Nitrogen of air, utilizat.... 483
North pole, no land at..... 27
Nova Ophiuchi, new star.... 459

O

Oars, manning *360
Ocean contests, great 398
Oil can, improved *108, *128
Oils, flashing point *408
Old and new 138
Omnibus, motor, Brush *62
Omnibus traffic, Isle of Wight 386
Optical convention 99
Orthoclase 4
Osler, Dr., what he said..... 243
Oyster dredge *327
Oxygen at home *421

P

Packing, boiler 303
Packing, manhole 22
Pail, milk, novel *468
Painting, chemistry of 298
Painting, surfaces for, prep. 438
Panama canal 143, *442
Panama canal, plans for.... 438
Panama canal, sea-level 238
Panama, our assets at..... 54
Panama, tides at 238
Pantagraph, reducing *202
Paper, aluminium 367
Paper, fabrics of 358
Paper making, peat for..... 460
Paper, waterproofing 63
Passenger station, Washington *401
Passenger steamers, device for 29
Passe-partout framing 143
Patent to Corn. Vanderbilt.. 163
Patent Department....*28, *128 *148, *267, *327, *408, *448
Patent for the public 139
Patents, brief notes on..29, 408, 448
Patrol wagon, gasoline *62
Pavement of whales' bones.. *76
Peat manufacture, electric.. 399
Peat for paper making 460
Pen, drawing, fountain *267
Philippines, population ..322, 343
Phonograph records, preserv. 419
Phosphorescence 239
Photography of the eye..... 143
Pike, Nicholas, death of.... 322
Pipe composition, new 223
Pistols and rifles, old *246
Pitcher, sirup *327
Planchette inquiry 27
Plant growth, electricity in. 458
Plants in carbon dioxide.... 39
Plaques, Pompeiian *346
Plate glass machine 483
Platform, moving 378, *382
Port Arthur *227
Port Arthur fleet, sunken.... 98
Port Arthur mystery 198
Port Arthur, operations at, *206, *207
Port Arthur, siege of..... *24
Potato, new variety 44
Power boat record 443
Power, tidal 122
Prizes in France 343
Press censor, Russian..... 479
Prunes, cultivation of *9

Q

Question, oft-repeated 418

R

Race, auto., decision 362
Race, auto, international.... 119
Race, Bennett cup 10
Race, yacht, ocean *432
Races, auto, in Europe 203
Racing season, auto, open.. 443
Radiators, electrical *141
Radio-active minerals 387
Radio-active substances 299
Radio-activity 2
Radium, new property..... 387
Radium in metals 318
Radium theories 102
Rail joint *228
Rail joint connection *267
Rail production in U. S..... 459
Rails, heavy 441
Rails, spreading of 228
Rails, the heaviest 468
Railroad, electric, long dist. 200
Railroad horror, recent 398
Railroad, Long Island, motors 22
Railroad, N. Y. C., electric.*142
Railroad, old portage *74
Railroad slaughter 158
Railroad speeds 423
Railroad tie and clamp *408
Railroad to Key West 139
Railroad, tube, Paris 363
Railroads, forestry and 7
Railroads in 1904 2
Railway, Chamonix-Aosta... 366
Railway congress, international 378
Railway, electric, single phase 486
Railway gage *268
Railway, gravity *168
Railway, Lake Baikal 459
Railway, Mt. Blanc, new... 306
Railway subaqueous *29
Railway ticket, legal life... 23
Railways, electric, and propul 258
Raisins 187
Ramsay, Sir William..... 319
Rays, N, from steel..... 179
Rays, radium, on metals.... 318
Rays, X, in medicine..... 208
Reamer for blast holes.....*228
Reclamation work in So. Calif 499
Record, auto, non-stop record. 443
Refrigerator, iceless *468
Reservoir, Croton, new.....*302
Reservoir, Jerome Park.....*381
Respiration, electric analogue 239
Retrospect of 1904 2
Revolver grip *28
Rheostat, simple *362
Rifle, machine, new..... 344
Rifles and pistols, old *246
Rifles, military 440
Rim for detachable tires....*261
Road, rolling, new *200
Road-testing machine *384
Rocky Mountain avalanches..*164
Rojestvensky 318
Rolling road, new *200
Rotating bodies, balance of.*148
Runabouts, Oldsmobile, test. 443

S

Safety device, electric....82, 105
Saharan sea, cretaceous 319
Salt making, California *264
Salt marshes of Congo 343
Saturn, tenth satellite of.... 383
Sawdust, alcohol from *304
Schedule vs, safety 38
School, swimming, horse....*261
Science Asso., American..... 27
Science notes..39, 55, 99, 179, 208, 239, 259, 299, 319, 359, 399, 419, 439, 459
Sciences, Nat. Academy of.. 359
Scopolamine 299
Scouts, British, new *161
Scrap heap, consigned to.... 258
Sea-sounding apparatus..... 55
Seam ripper *29
Sentiment vs. commercialism. 403
Sentiment vs. sense 363
"Sentinel," British scout....*161
"Sevastopol," battleship....*206
Shari, soil of the..... 359
Shell-digger *327
Shingle cutter *327
Ship, bearing of, determin.. 39
Ships, gas-driven 98
Silverware, Pompeiian *346
Simplon tunnel *226, 322
Sinai peninsula 319
Sirup pitcher *327
Sketch box *327
Ski in peace and war.....*124
Skin, luminous phenom..... 305
Sleigh, motor, new *57, *84
Smoke, methyl aldehyde in.. 459
Snow crystals *21
Snow statuary *241
Soap, anti-toxic 368
Soap, dangers in 383
Soap, unsanitary 223
Soaps, toilet, disease from.. 183
Soil inoculation 218
Solar prominences 55
Sounding apparatus *323
Specter tarsius *167
Speed and accuracy contest. 301
Square root, determ..... 303
Stanley, monument for 54
Star, a new 459
Stars, variable, discov.....*485
Stars in daylight 363
Station, Grand Central *40
Statuary, snow *240
Steam, heat loss of..... 479
Steam vs. electricity *407
Steamers, tramp, turbines for 158
Steamships, American, large. 366
Steel cars, and safe travel.. 178
Steel castings 247
Steel, tool, new 462
Steel, wrought, direct process 159
Steering device, auto..... 483
Stereogram, parallax *76
Stone ball, moving 322, 403
Stone, Baalbec, moving 502
Stone sawing by wire..... 182
Stove, new type of 223
Street cleaner, auto..... 443
Street sprinkler, electric....*326
Submarine, Brit., lost.....*481
Submarine boat disasters... 478
Submarine, explosion of..... 159
Submarine, French, new 140
Submarine, Italian, new 19
Submarines, new, British...*481
Submarine, new type 7
Subway competition 338
Subway plan, to complete the 278
Subway, platform *382
Subways, freight, Chicago...*205
Subway, ventilation of 478
Sugar industry, Japan 447
Sun, corona of, photography of 459
Sun spots, new 199
Sun spots, our knowledge of.*147
Superstitions, rural 418
Swimming school, horse *261
Switches, elec.-operated..... 506

T

Tank indicator, magnetic ...*203
Tapestry, Gobelin *384
Tarpon, leaping of *348
Tarsius, specter, a *167
Taxidermy, process 384
Tea slabs, Russian *308
Telegraph, Congo 43
Telegraph, space 6
Telegraph, wireless, railway 479
Telegraphy, wireless 39, 41
Telephone, electrolytic 5
Tender, locomotive, new..... 163
Tent fastener *368
"Terra Nova," steamship ... 423
Textile fabrics of paper 358
Thawing out pipes *140
Thermometer, high pressure.*427
Thermometer, mercury *160
Thermometer, registering ...*243
Thoria 262
Thorianite 239
Tides at Colon and Panama. 238
Timber, preserved, strength, 118, 378
Time, standard *300
Timing apparatus, auto..... *72
Tire, puncture-proof *448
Tires, damage to 10
Tires, non-skid *72
Tobacco pouch *128
Togo and his flagship *464
Tombs at Mukden *244
Too much of good thing..... 200
Tool steel, new 462
Tornado, freaks of 423
Torpedo, aerial 443
Towing tank, value of 118
Traction, electric, heavy.... 298
Trade-mark law 268
Trade-mark law, Chinese.... 126
Trade-mark law, new.19, 126, 178
Trade-mark law, passage... 99
Traffic, suburban, London.... 218
Train, snowbound, telephony on 188
Train stop, automatic 122
Trains, freight, explosions on. 418
Trains, long-distance 478
Transformer for thawing pipes *140
Transmission voltages 479
Transmitter, wireless *263
Tree planting, Pennsylv. RR. 140
Trees as antennae....*117, *123
Trolley lamp *268
Trousers hanger 28
Truck, electric, new *505
Truck, gasoline *63
Truffles, culture of 399
Tuberculosis from milk 27
Tuna, leaping of the *348
Tunnel, East Boston *44
Tunnel, Simplon *226, 322
Turbine Atlantic liner 338
Turbine cruisers 118
Turbine, gas, Stolze *74
Turbine, Parsons 468
Turbine steam yacht, new... 19
Turbine steamer "Loongana" 182
Turbine steamer "Manxman" *8
Turbine steamer, new..... 107
Turbine steamer "Virginia". 423
Turbine, water, largest..... *6
Turbines for tramp steamers. 158
Turbines, steam, De Laval... 432
Turbines, steam, powerful... 346
Turpentining, experiments in. 198
Turret of a battleship..... 103
Typewriters, manufacture of, *197, *201, *202

U

Umtali, discoveries in 439
University, Geo. Washington. 258

V

Valise handle *128
Vases, Pompeiian *346
Vehicle attachment *108
Vehicles, commercial *62
Velocity of the universe 146
Ventilating, U. S. capital.... 323
Vesuvius of America *321
Vesuvius, researches on..... 338
Ventilation of subway 478
Viaduct, River Indus 423
Viagraph, the *384
Victoria Falls, harnessing...*344
Victory, unparalleled 458
Violins, making 166
Virgin lace of the tropics..*340
"Virginia," turbine steamer. 423
Viscosimeter, new *408
Voice, mechanism of 458
Voltages, transmission 479
"Vulcan," dredger *24

W

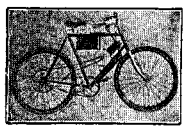
Wagon, delivery, Oldsmobile. *62
Wagon, patrol, gasoline *62
Wagons, delivery *62
Wagons, mail, electric *440
Wantibo, a *167
War, Japanese, lessons of... 18
War, Russo-Japanese, ethics 502
Warfare by telegraph 54
Warships of future 498
Washington University 258
Waste, household, burning... 242
Watch demagnetizer *368
Watch, remarkable *20
Watch, tachometric *160
Watch works, a modern *300
Watches, antique *165
Water purification 219
Water, self-pumped 184
Water supply, New York.158, 218
Water supply, N. Y., increasing 498
Water wheel, novel *20
Waves, elec., and liquids.... 499
Waves, Hertzian 219
Weather observations 262
Weather prognostication 179
Weed-cutting launch *426
Westrumite to lay dust..... 423
Wheel, rolling, motion 502
Wheel, spring, automobile.... *64
Wheel, water, novel *20
Whispering gallery, Washington 219
Whistle, automobile *483
Wind pressure on bridges, 138, 198
Windmills, German *245
Wood preservative 188

Y

Yacht for King Edward..... 363
Yacht race, ocean *422, *462
Yacht race, 3,000-mile.*402, *405
Yacht, steam turbine 19

All makes of Cameras and Lenses at Bargain Prices.
Get our latest lists—we save you money.
Films developed.
Bromide Enlargements.
Photo work of all kinds at lowest prices.
We buy and exchange.
We carry the famous Lumiere Plates —try them.

NATIONAL COMPANY,
49 West 28th Street, New York City.

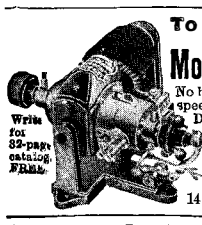


Convert your Bicycle into a Motor-Cycle or your Boat into a Launch by using one of the **Steffey Motors.** Also a complete line of Motors and Castings for Auto or Stationary. Lowest prices. Send stamp for catalog
STEFFEY MFG. CO.
2720 Brown St., Phila., Pa.

Micro Scopes

Our Microscopes, Microtomes, Laboratory Glassware, Chemical Apparatus, Chemicals, Photo Lenses and Shutters, Field Glasses, Projection Apparatus, Photo-Micro Cameras are used by the leading Laboratories and Government Departments Round the World.
Catalogs free.
BAUSCH & LOMB OPT. CO.
ROCHESTER, N.Y.

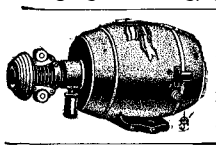
OSGOOD STANDARD SCALES
For Farm Use
Send for Catalogue S
OSGOOD SCALE CO. Binghamton, N. Y.



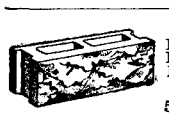
To Gas Engine Operators
Dynamo Ignition.
Motsinger Auto-Sparker
No battery to start or run. The original speed-controlled friction-drive Dynamo. Driven parallel with engine shaft. No belts. No beveled pulley or beveled fly wheel necessary. For make and break and jump-spark system. Water and dust proof. FULLY GUARANTEED.
Write for 32-page catalog. FREE.
MOTSINGER DEVICE MFG. CO.,
14 Main Street, Pendleton, Ind., U.S.A.

Bashlin Telephone Disinfector
One of the greatest sanitary inventions of the age. Endorsed by forty Health Boards throughout the United States.
Prevents Moisture, Dust, Micro-organisms, in fact all foreign matter from entering the mouthpiece.
Frees the telephone of all obnoxious odors. Prevents inoculation. Improves transmission.
Price 50 cents. Postpaid.
AGENTS WANTED.
Tatem Manufacturing Company
BUFFALO, N. Y., U. S. A.

Ingwidgit
TRANSLATORS of pamphlets, catalogs, letters, labels. Printers, Booksellers, Newsdealers, in Many Languages.
LANGUAGES PRINTING COMPANY
Languages Building, 15 West 18th St., New York



Every Gas Engine User
should learn about the **Apple Automatic Sparker.** Easily attached. No more belt, battery or commutator troubles. Increases power and speeds For any kind of ignition apparatus write
The Dayton Electrical Mfg. Co.
98 Beaver Bldg. Dayton, Ohio.



A MONEY MAKER
Hollow Concrete Building Blocks, Best, Fastest. Simplest, Cheapest Machine. Fully guaranteed.
THE PETTYJOHN CO.
513 N. 9th Street, Terre Haute, Ind

THE Nulite Vapor GAS Lamps
For Home, Store and Street
We also manufacture Table Lamps, Wall Lamps, Chandeliers, Street Lamps, Etc. 100 Candle Power seven hours ONE CENT. No Wicks. No Smoke. No Odor. Absolutely safe. THEY SELL AT SIGHT. Exclusive territory to good agents. Write for catalogue and prices.
Chicago Solar Light Co. Dept. G, Chicago

50 Years' Experience
PATENTS
Trade Marks, Designs, Copyrights, Etc.
Anyone sending a sketch and description may quickly ascertain our opinion free whether an invention is probably patentable. Communications strictly confidential. Handbook on Patents sent free. Oldest agency for securing patents.
Patents taken through MUNN & Co. receive *Special Notice*, without charge, in the
Scientific American
A handsomely illustrated weekly. Largest circulation of any scientific journal. Terms, $3 a year; four months, $1. Sold by all newsdealers.
MUNN & CO. 361 Broadway, **NEW YORK**
Branch Office 625 F St. Washington, D. C.

Telegraphic signaling key, J. A. Fleming... 792,015
Telegraphy, electric, I. Kitsee... 792,052
Telegraphy, transmitting apparatus for wireless, J. A. Fleming... 792,014
Telegraphy, wireless, G. Marconi... 792,528
Tension plate, S. W. Wardwell... 792,093
Testing machine, J. E. Hitch... 792,037
Theater chair, Wierssching & Bergstrom... 792,566
Theatrical device, V. Waid... 792,481
Thill coupling, J. D. Tam... 792,086
Timber preservative, R. P. Reynolds... 792,458
Time wheel mechanism, Deeley & Quinlan. 792,572
Tire casings to clincher rims, tool for applying clincher, E. N. Downs... 792,009
Tire, pneumatic, P. E. Doolittle... 792,008
Tire, pneumatic, C. S. Sears... 792,290
Tire, vehicle, J. C. Raymond... 792,075
Tobacco cutting machine, E. Quester... 792,453
Toilet article, R. R. Debacher... 792,251
Tool, combination, J. D. Wages... 792,480
Tool, pneumatic, H. Leineweber... 792,333
Toothpick, J. L. Smith... 792,471
Toy, P. Heftler... 792,130
Track, H. L. Ferris... 792,254
Transformer lead, J. J. Frank... 792,016
Traveling bag, G. Tiderman... 792,183
Tread, elastic, P. W. Pratt... 792,555
Tree cancer, remedy for, E. Homann... 792,518
Trolley head, power driven, W. J. Sumner... 792,176, 792,177
Trousers, F. G. White... 792,097
Truck, car, J. C. Wands... 792,482
Trunk, Andrews & Wyman... 792,246
Truss, F. King... 792,424
Truss, hernial, F. B. Allshouse... 792,305
Tube, pipe, or cylinder coating machine, A. W. Buchanan... 792,394
Tubes with veneers, covering metal, L. Coburn... 792,005
Tubing, manufacture of, P. Patterson... 792,446
Turbine, elastic fluid, M. Matthews... 792,143
Turbines, rotary packing for elastic fluid, F. Hodgkinson... 792,131
Turpentine box, A. C. McLeod... 792,542
Turpentine cup, White & Gardner... 792,483
Twyer iron, C. O. Swenson... 792,179
Type casting machine centering mechanism, Bancroft & Indahl... 792,247
Typographical blocks, manufacturing, G. H. Calmels... 792,313
Umbrella, G. Ericson... 792,408
Umbrella holder, M. E. Freund... 792,126
Unicycle, C. G. Crosse... 792,403
Valise attachment, L. L. Downing... 792,204
Valve, F. Schreidt... 792,353
Valve apparatus, F. Grinnell... 792,258
Valve, cylinder relief, M. R. Zehnder... 792,378
Valve, distributing, J. Trapp... 792,090
Valve, engineer's air brake, J. F. McElroy. 792,152
Valve for compressed air brakes, expansion and triple, W. R. Smith... 792,558
Valve gear, engine, J. L. Wheeler... 792,372
Vapor burner, H. C. Hornish... 792,519
Vapor burner, E. Thomson... 792,562
Vapor burner thermoregulator, E. Thomson. 792,087
Vault, burial, R. F. Folk... 792,510
Vault, metallic grave, D. B. Hiser... 792,036
Vegetable cutter, J. N. Buell... 792,396
Vehicle brake block, M. Potter... 792,554
Vehicle controlling device, motor, T. L. & T. J. Sturtevant... 792,241
Vehicle gear, F. E. Wilcox... 792,484
Vehicle, motor, J. F. Duryea... 792,573
Vehicle wheel, Cochran & Gilmore... 792,199
Vehicle wheel, S. S. Scott... 792,468
Vending machine, G. B. Townsend... 792,296
Voting machine, W. J. Wilkinson... 792,373
Vulcanizing mold, H. Z. Cobb... 792,198
Wagon loader, W. Anderson... 792,488
Walls, erecting, E. Pruss... 792,451
Washing machine, G. W. Ray... 792,456
Washing or churning apparatus, C. R. Gustavson... 792,415
Watch stem winding and setting mechanism, A. Guggisberg... 792,414
Watchmaker's instrument, C. M. Thomsen. 792,367
Water, apparatus for producing purified, G. Knodler... 792,426
Water elevator, current operated, T. H. Dolling, et al... 792,505
Water forcing apparatus, M. A. Libbey... 792,429
Water heater, G. R. Burt... 792,496
Wave motor, G. M. Lynch... 792,224
Weaner muzzle, calf, W. A. Abbett... 792,187
Weather strip, window, W. Peace... 792,286
Wedge bolt, W. Thissen... 792,181
Weeder, M. McEachern... 792,541
Weighing and delivering apparatus, beet, J. S. Eash... 792,406
Weir, H. Herzig... 792,517
Well drill, oil, J. E. Downer... 792,322
Well piston or plunger, deep, C. M. Ray.. 792,349
Welts into stitched seams, guide for introducing corded, O. E. Brown... 792,116
Wheel. See Car wheel.
Wheel, H. T. Hansen... 792,026
Winding machine, S. W. Wardwell... 792,565
Wire, film coated, J. G. Callan... 792,001
Wire, making ingots for seamless gold plated, H. M. Williams... 792,098, 792,099
Wires or bars to pieces of metal, plug or bush for connecting, E. A. Richardson, reissue... 12,359
Wrench, S. B. House... 792,213
Wrench, J. W. Woodard... 792,487
Wrench, W. H. F. Tenny... 792,560
Yoke, harness, W. G. Parker... 792,069

DESIGNS.

Badge, C. J. Dieges... 37,461
Chair frame, W. H. Redmond... 37,462

LABELS.

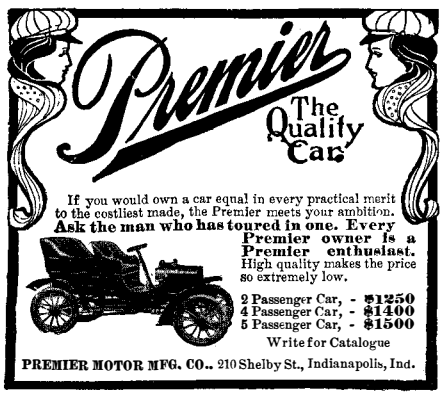
"Banzai," for a tonic, S. Hochstadter... 12,207
"Cauffman's," for ginger brandy, E. Cauffman & Co.... 12,206
"Dixie Flake," for a confection, Robert A. Johnston Co.... 12,196
"Linfa," for cigars, Cole Lithographing Co.. 12,197
"Lowry's Red Cordial," for a medicine, J. I. Lowry... 12,199
"Lyric Record," for talking machine records, International Record Co.... 12,209
"M C Split," for mineral water, Ponce de Leon Mineral Water Co.... 12,200
"Mme. Wilbur's Eureka Face Cream," for a cosmetic, E. W. Prather... 12,195
"Mozart Record," for talking machine records, International Record Co.... 12,208
"Nica Pana," for cigars, Schmidt & Co.... 12,198
"Our Home Comfort," for coffee, Vogel Bros. & Co.... 12,201
"Selby Blue and Gold Brand," for white lead, Selby Smelting and Lead Co.... 12,210
"Trimble," for whisky, White, Hentz & Co.... 12,202 to 12,205

PRINTS.

"A Nice Hand to Hold. Congress Cards Make Players Happy. Initial, Pictorial & Club Backs," for playing cards, United States Playing Card Co.... 1,349
"Circus Dolls No. 1," for patterns for paper dolls, Gray Lithograph Co.... 1,347
"For Purity," for beer, Cream City Brewing Co.... 1,344
"Gordon Suspender Girl," for suspenders, Gordon Manufacturing Co.... 1,346
"Muslin Underwear," for underwear, Ferguson-McKinney Dry Goods Co.... 1,345
"Selby Blue and Gold Brand," for white lead, Selby Smelting and Lead Co.... 1,350
"Still Alarm and Summer Backs, Congress Playing Cards," for playing cards, United States Playing Card Co.... 1,348

A printed copy of the specification and drawing of any patent in the foregoing list, or any patent in print issued since 1863, will be furnished from this office for 10 cents, provided the name and number of the patent desired and the date be given. Address Munn & Co., 361 Broadway, New York.

Canadian patents may now be obtained by the inventors for any of the inventions named in the foregoing list. For terms and further particulars address Munn & Co., 361 Broadway, New York.



If you would own a car equal in every practical merit to the costliest made, the Premier meets your ambition. **Ask the man who has toured in one. Every Premier owner is a Premier enthusiast.** High quality makes the price so extremely low.
2 Passenger Car, - $1250
4 Passenger Car, - $1400
5 Passenger Car, - $1500
Write for Catalogue
PREMIER MOTOR MFG. CO., 210 Shelby St., Indianapolis, Ind.

Clean House With Air
Over 55 companies operating Thurman Patents in America, and as many more in Canada, England, and Europe.
FREE CATALOGUE.
General Compressed Air House Cleaning Co.
ST. LOUIS, U. S. A.
Manufacturers of the Celebrated Thurman direct-connected Gasolene Driven Air Compressors for Mines, Pneumatic Tools, Etc.

SPECIAL MANUFACTURING.
DIES AND STAMPINGS TO ORDER.
SPEC'L MACHINERY-MODELS-EXPERIMENTAL WORK.
DROP FORGING DIES AND DROP FORGINGS.
HARDWARE SPECIALTIES ETC. MANF'D TO ORDER. SEND SAMPLES OR DRAWINGS FOR ESTIMATES. WRITE FOR OUR BOOKLET.
THE GLOBE MACHINE & STAMPING CO.
970 HAMILTON ST., CLEVELAND, OHIO.

ICE MACHINES. Corliss Engines, Brewers' and Bottlers' Machinery. THE VILTER MFG. CO., 899 Clinton St., Milwaukee, Wis

MODELS & EXPERIMENTAL WORK. Inventions developed. Special Machinery.
E. V. BILLAARD, 24 Frankfort Street, New York.

Dies, Tools, Models and Special Machinery. Metal Specialties and Stampings Manufactured.
HOEFT. & MOORE, Chicago, U. S. A.
OFFICE: 85-87 Fifth Avenue. WORKS: Indiana & Franklin Streets.

BALLOONS Aeronaut L. Stevens, Box 181 Madison Sq., N. Y.

DRYING MACHINES. S. E. WORRELL Hannibal, Mo.

MODELS & GEARS INVENTIONS PERFECTED UNION MODEL WORKS 193 So. CLARK ST. CHICAGO.

RUBBER Exper' Manufacturers Fine Jobbing Work
PARKER, STEARNS & SUTTON, 228-229 South St., New York

MODELS CHICAGO MODEL WORKS
ESTABLISHED 1867 179 E. MADISON ST. CHICAGO, ILL.
WRITE FOR CATALOGUE OF MODEL SUPPLIES.

The OPTICAL INSTRUMENT MONTHLY
Just started. Send for sample copy.
E. P. BUFFET, 108 Fulton Street, New York

INVENTORS' AND MACHINISTS' Machines and Tools designed. Inventions perfected. Accurate drafting. C. H. M'Glehan & Co., 110 W. 34th St., N. Y.

MODEL AND EXPERIMENTAL WORK.
Electrical and Mechanical Instruments. Small Mach'y
EDWARD KLEINSCHMIDT, 82 W. Broadway, New York

MODELS, DIES AND TOOLS
Repairing of machinery. Brass novelties and metal articles made under contract or on royalty.
LOVINGTON MFG. CO., Lovington, Ill.

Just Out! Shows how to cut all kinds of Rafters, gives Degrees, Pitches, Polygons, Ovals, Ellipses, etc. Introductory price, 10c.
Dwight L. Stoddard, Author of Steel Square Pocket Book, 3:8 W. Raymond St., Indianapolis, Ind.

We Make and Market Patented Articles
Experimental Work and Models. Metal Stamping and Die Work and General Machine Shop.
Anglo-American Corporation, 124 Baxter St., New York

PLUMBING SCHOOLS
WANTED—Men and boys to learn plumbing trade We cannot supply demand for graduates. $4.50 to $5.00 per day. Eight weeks completes course. Earn while learning. Address for catalogue COYNE BROS. Co., Plumbing Schools, Cincinnati, O., St. Louis, Mo. Employment guaranteed or money refunded.

LEARN WATCHMAKING
Refined, profitable labor. Competent men always in demand. We teach it thoroughly in as many months as it formerly took years. Does away with tedious apprenticeship. Money earned while studying. Positions secured. Easy terms. Send for catalog.
ST. LOUIS WATCHMAKING SCHOOL, St. Louis, Mo.

INVENTORS We manufacture METAL SPECIALTIES of all kinds, to order; largest equipment; lowest prices. Send sample or model for low estimate and best expert advice **FREE**
THE EAGLE TOOL CO., Dept. A, Cincinnati, O.

NAME PLATES—STEEL STAMPS
EMPLOYEE CHECKS, KEY TAGS & BADGES.
J. ROBBINS MFG. CO. 58 KNEELAND ST.
SEND FOR CATALOGUE ..... BOSTON, MASS.

Are you interested in Patents, Model or Experimental work? Our booklet entitled
WHAT WE DO—HOW WE DO IT
will be sent to you on request.
KNICKERBOCKER MACHINE WORKS, Inc., 8-10-12 Jones Street, New York.

You want a good noise maker. Don't risk your life fooling with a toy pistol, but buy a
YoungAmerica Double Action Revolver
$2.50
Safe Reliable Durable
22 caliber, 7 shot, rim fire.
32 caliber, 5 shot, rim or center fire.
If not to be had of your dealer write us, stating preference and enclosing amount, and we will supply you by return mail or express, sending prepaid. *Write for Free Catalog.*
HARRINGTON & RICHARDSON ARMS CO. 328 PARK AVE. WORCESTER, MASS.

FOR SALE One almost new Hydraulic Flanging and Drawing Press. Five 12-in. plungers with 5-in. stroke exerting pressure of 400 tons at 2,000 lbs. The Platen is 5 ft. x 7 ft. 6 in. Distance from head to table of press, 8 ft. 6 in. Massive Head and Lifting Table, each cast in a single piece of steel. The four 8-in. columns supporting press are forged steel turned true. Four overhead jackarms 4½-in. cylinders 48-in. stroke for clamping work to lifting table. One almost new five-cylinder 60-gal. Hydraulic Pump with automatic alleviating valve for operating above. Also one second-hand 20-gal. Hydraulic Pump. Special low figures quoted on one or all of above. Address
PHILLIPS PRESSED STEEL CO., Joliet, Ill.

AUTO STORAGE BATTERIES ALL KINDS
THE WILLARD STORAGE BATTERY CO. CLEVELAND, O.

AGENTS WANTED
in every railway shop to solicit subscriptions for the
RAILWAY MASTER MECHANIC
ONE DOLLAR A YEAR
LIBERAL COMMISSION TO AGENTS
Address **RAILWAY MASTER MECHANIC**
305 Dearborn St., Chicago

NOW READY

Bound Volume
OF THE
SCIENTIFIC AMERICAN BUILDING MONTHLY
VOLUME XXXIX
January to June, 1905
277 Illustrations 6 Covers in Tint
132 Pages
PRICE OF SEMI-ANNUAL VOLUME $2.00, POSTAGE PAID

SPECIAL FEATURES
Notable American Houses.
By Barr Ferree.
Mrs. A. Cass Canfield's House, Roslyn, L. I., N. Y.
The House of Ogden Mills, Esq., Staatsburg, N. Y.
"Bellefontaine," the Estate of Giraud Foster, Esq., Lenox, Mass.
The House of Lloyd Bryce, Esq., Roslyn, L. I., N. Y.
"Martin Hall," the House of James E. Martin, Esq., Great Neck, L. I., N. Y.
"Talbot House," the Estate of **Talbot J. Taylor**, Esq., Cedarhurst, L. I., N. Y.

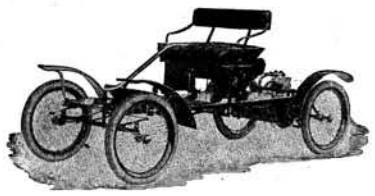
Helps to Home Building. What the House Builder should know. Difficulties to Overcome. The Plan. The Structure. Designing the House. The Rooms and Their Uses.

Departments. Roads. Landscape Architecture. Ventilation. New Building Patents. Publishers' Department. The Automobile. The Plumber. Exhibitions. Correspondence. Fire Protection. Civic Betterment. Unknown Buildings. The House. Monthly Comment. The Household. The Garden. Fifty Suggestions for the House. The House Interior. New Books. Sanitation.

The Building Monthly aims to help its readers to better building. The illustrations reproduce homes and other structures of the highest grade and of varying costs. It seeks to interest the architect, the house owner, the real estate promoter, the home maker, and the builder. It stands for the good and the true and the beautiful in the art. Its series on "Notable American Houses" describes and illustrates with great wealth of illustrations the more important of the best large houses recently built in the United States and brings its readers in immediate touch with the most important work of the leading architects of the day. Its descriptions of houses are brief but compact with information. Its departments constitute a "review of reviews," summary of current comment, suggestion and help in all matters relating to the construction of the home, its decoration, equipment, and use.

Volume XXXIX. January to June, 1905, price $2.00. Six covers in tint and three hundred and eight illustrations. A rich conspectus of interesting notable houses. Many fine estates are treated with ample fullness. The discussions of current architectural themes are of permanent value and of unusual interest.

FOR SALE BY
MUNN & COMPANY
No. 361 Broadway, New York City
AND ALL NEWSDEALERS



Orient Buckboard, 4 H. P, Price $375.

If You Had An Orient Buckboard

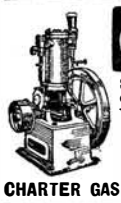
you could ride anywhere and everywhere at a cost of less than ½ cent a mile. You could learn to drive a Buckboard in half an hour, and the car is so light and fast you could run away from more than half the big touring cars on the road.

This year's Orient Buckboard has simplified carbureter, improved muffler, larger spring surface, almost noiseless driving pinions, and a new starting device that is a wonder for ease of operation.

Four styles, at $375, $450, $475 and $525. Catalogue free

WALTHAM MFG. CO., Dept. H, Waltham, Mass.

Members of Association of Licensed Automobile Manufacturers.



CHARTER

Stationaries, Portables, Hoisters, Pumpers, Sawing and Boat Outfits, Combined with Dynamos.

Gasoline, Gas, Kerosene.

Send for Catalogue.

State Power Needs.

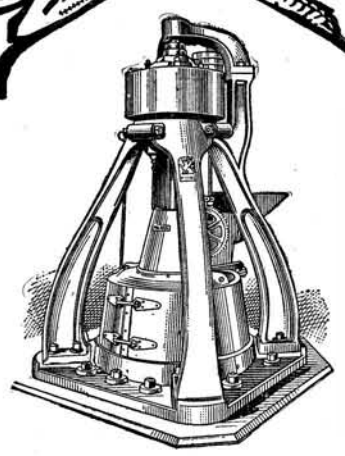
CHARTER GAS ENGINE CO., Box 148, STERLING, ILL.

RUST ON GUNS TOOLS & CYCLES **PREVENTED** BY **MANNOCITIN**

C. H. BESLY & CO. CHICAGO ILL. U.S.A.

15 to 21 Clinton Street.

THE GRIFFIN MILL



The Greatest Pulverizing Machine in the World

Used Wherever Portland Cement Is Made

Over 50 per cent. of the Portland Cement manufactured in the United States to-day is ground in the Griffin Mill.

THE GRIFFIN MILL PULVERIZES MORE CEMENT THAN THE COMBINED OUTPUT OF ALL OTHER MACHINES USED FOR THIS PURPOSE.

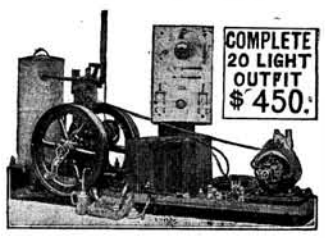
Thoroughly tested by continually successful and constantly increasing use during the past sixteen years.

Portland Cement Clinker reduced from ½ inch to required fineness in one operation, with no auxiliary apparatus. No other machine made will do this.

Buy the GRIFFIN MILL and get the BEST. It holds the world record from every standpoint.

Send for Catalogue and full information.

BRADLEY PULVERIZER COMPANY, 92 State Street, Boston



We have complete Outfits for .... **YOUR OWN ELECTRIC LIGHTS**

Any size place, summer homes, launches, yachts, etc. Every detail included; very best material; practical. So simple no electrician required. **Light All the Time,** as storage battery included. **Gas, Gasoline** or **Steam** engines used give plenty of power for pumping water, sawing wood, refrigeration, etc. For our new 56-page Catalogue describing over 100 different outfits, address

ELECTRIC DEPARTMENT

RICHARDSON ENGINEERING CO., Hartford, Conn.

JESSOP STEEL CO MFRS OF CRUCIBLE SHEET STEEL WASHINGTON, PA.

Scales All varieties at lowest prices. Best Railroad Track and Wagon or Stock Scales made. Also 1000 useful articles, including Safes, Sewing Machines, Bicycles, Tools, etc. Save Money. Lists Free. CHICAGO SCALE CO., Chicago, Ill.

SURREY, TYPE ONE
16-18 horse power, $1350.
Other models $750, $850, $2000, $3000.
Full information on request.

IN *May 1904* the Moxie Nerve Food Company of Boston bought one of our touring cars, and drove it over eight thousand miles in the distribution of advertising literature.

They spent but a trifle over five dollars for repairs during the entire season. ¶In March of this year they bought six of the model pictured here—already increased their commercial machines, together with the comments and counts of trips made by others, will be sent you on request. We will also tell you in detail why our machines are perfectly suited to American roads.

Received
Jun 2d Military Information Division
Chief of Staff War Dept
1905

Main Office and Factory: Kenosha, Wisconsin.
Branches, Boston, Chicago, Philadelphia.
New York Agency, 134 West Thirty-eighth Street.
Representatives in all other leading cities.

THOMAS B. JEFFERY & COMPANY.

FISK TIRES

SECURELY LOCKED TO RIM!

INSURING POSITIVE SAFETY

It is their Exclusive Features which have given FISK TIRES world-wide celebrity. These points of advantage, combined with Durability (insured by the finest quality and workmanship) have caused its enthusiastic endorsement by everyone of experience. : : :

Note the Air Space—It's all above the rim!

THE FISK RUBBER CO., Chicopee Falls, Mass., U. S. A.

What Is Daus' Tip-Top?

TO PROVE that Daus' "Tip-Top" is the best and simplest device for making **100 copies** from pen-written and **50 copies** from typewritten original, we will ship complete duplicator, cap size, **without deposit,** on **ten (10) days' trial.**

Price $7.50 less trade discount of 33⅓ per cent, or $5 Net

The Felix A. B. Daus Duplicator Co., Daus Bldg., 111 John St., New York

---

The New Model... Air Gun

Shoots 21-100 Darts and Slugs

37 inches long, 70 ounces weight, with appurtenances 93 ounces. For close shooting and gallery use. Easy to load and fire. Six darts, six targets, 100 slugs included, for **$6.25.**

H. M. QUACKENBUSH, Manufacturer, Herkimer, N. Y.

BRISTOL'S RECORDING INSTRUMENTS.

Pressure Gauges, Vacuum Gauges, Voltmeters, Amperemeters, Wattmeters, and Thermometers, make continuous records *Day and Night.* Will pay for themselves. Every instrument fully guaranteed and sent on 30 days' trial. ☞ *Send for Circulars and Specimen Chart.*

The Bristol Company, Waterbury, Conn.

GOLD MEDAL, ST. LOUIS EXPOSITION.

The Most Modern Marine Motor

having the most rapid speed and weighing least per h. p. and possessing the fewest parts is the **Van Auken Motor.** No vibration, easy to operate, simple, reliable, clean. Great power. Perfect control. Always ready. Every stroke cleans the cylinder.

VAN AUKEN-CLEVAUC CO. Yonkers, N. Y., U. S. A.

Jiu-Jitsu Instruction by President Roosevelt's Teacher

JIU-JITSU INSTRUCTION 6c.

NATURE'S WEAPON THAT NEVER FAILS

MAKES SMALL MEN STRONG GIANTS

Japan succeeds because of the physical fitness of her soldiers. They practice Jiu-Jitsu, a system of physical culture which makes them giants of strength and endurance.

P. S.—Send six cents in stamps for FREE instructions

THE AMERICAN COLLEGE OF PHYSICAL CULTURE & JIU-JITSU
378 Boylston Street, Boston, Mass.

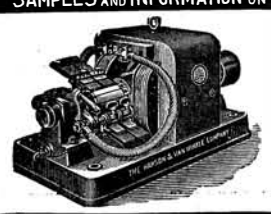
PRINTING THAT BRINGS RESULTS PAYS YOU

WE attend to every detail of Writing, Illustrating, Printing and Binding Booklets. Inventors and manufacturers wishing to sell or exploit their patents can do it very effectively by good circulars and booklets. Estimates furnished. Send 8c. postage for samples and handsome souvenir engraving of St. Louis Exposition, 14x20. on 20x24 paper.

C. L. WRIGHT & CO., 132-4-6 West 14th Street, New York.

COLD GALVANIZING.

AMERICAN PROCESS. NO ROYALTIES.
SAMPLES AND INFORMATION ON APPLICATION.

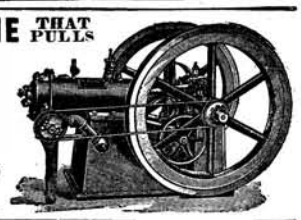


NICKEL AND Electro-Plating Apparatus and Material.

THE **Hanson & VanWinkle Co.,**
Newark, N. J.
92 William St., N. Y.
30 & 32 S. Canal St. Chicago.

THE ENGINE THAT PULLS

with a strong, steady pull. Used and recommended by thousands. A postal card with your name and address will bring particulars. Our machines and prices will interest you.



Hagan Gas Engine & Mfg. Co.
Winchester, Ky., U.S.A.

NON SKIDDING

UNPUNCTURABLE

SAMSON LEATHER TIRE

A. E. GALLIEN, Mgr.

UNITED STATES BRANCHES

NEW YORK	BOSTON	PHILADELPHIA
12 West 33d St.	20 Park Square	1120 Chestnut St.

CHICAGO, 1461 Michigan Boulevard. CLEVELAND, 406 Erie St.